Advances in Game-Based Learning

Katrin Becker

Choosing and Using Digital Games in the Classroom

A Practical Guide

Springer

Advances in Game-Based Learning

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Katrin Becker
Mount Royal University
Calgary, AB, Canada

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Preface

"If we teach today's students as we did yesterday's, we are robbing them of tomorrow."

John Dewey

Being able to assess a game's design before it gets used in the classroom has never been more important.

Who This Book Is for

This book is primarily for teachers—both present and future—as well as those who teach teachers. It is intended to provide all the information a practitioner in education will need to be able to plan for and use games in the classroom effectively.

It is suitable for use as a textbook in a pre-service or master's education program but down-to-earth enough to be of value to any teacher interested in learning how to use games in the classroom. It assumes no prior background in game studies but does assume you have an interest in teaching.

I am assuming that since you are reading *this* book, you are already convinced that there is potential value in using games for learning (G4L), even if you may not be really clear on how. Even though you may already be convinced, your supervisors, coworkers, or managers may not, so this volume will provide the background and research that can help you make your case.

What This Book Covers

If you only have one book about games in the classroom, this should be the one.
It covers:

- The basics of Digital Game-Based Learning (DGBL). This is about learning with games, including the theoretical underpinnings.
- The basics of Game-Based Pedagogy which is the other side of the DGBL coin. Here we talk about teaching with games, and this includes the theoretical underpinnings too, but this time from an instructional perspective.
- The challenges and rewards of using games in the classroom.
- Commercial Off-The-Shelf Games (COTS Games)
  - What they are.
  - How to choose them.
  - How to use them.
- The Magic Bullet model for assessing the learning potential in a game.
  - What it is.
  - How to use it as a tool.
  - How to evaluate games to determine if they will be a good fit for what you want.
- The four pillars of game pedagogy a.k.a. 4PEG (4 pillars of educational games), which includes:
  - The game pillar, to assess how well the game works as a game.
  - The educational content pillar, to assess the educational value of the game.
  - The teacher's support pillar, to assess the kind of support that exists for teachers who use the game in the classroom.
  - The overall balance pillar, to assess how the educational components are balanced within the game.
- Examples of evaluations:
  - Each evaluation is explained in some detail to give you an idea of how the evaluation model works.
- A discussion of how instructional design can be adapted to game-based pedagogy and a model for creating lessons that incorporate games.
- An entire section on how to create lesson plans using games—from single lessons to complete curricula, with examples.

How This Book Is Structured

This book goes over the theory behind game-based learning and pedagogy in a way that is accessible for both pre-service and in-service teachers, as well as administrators and anyone else involved in formal education, whether that is at the K-12 level or post-secondary education. It starts with explanations and proceeds to examples.

This book is broken into three parts.

Part I provides foundational and pedagogical background.
Part II introduces the analysis models and shows how they work using examples.
Part III explains how to create lessons using games and provides examples.

Plain language is used wherever possible. This is not a stuffy academic work, but it does include references to lots of research and other resources. Games in the classroom are not a flash in the pan—there is real research behind it and this book provides hundreds of references for anyone who wants to follow up formally.

This book has extensive supplementary materials, including:

- Summaries of
  - Learning theories
  - Instructional design theories
  - Instructional design models
- Templates:
  - Game analysis
  - Lesson Plans

    Single
    Unit
  - Course Plan
  - Study Guide
  - Teacher's Guide
- Lists:
  - 20 learning theories embodied in games.
  - 15 instructional theories embodied in games.
  - 12 instructional design models for using games in the classroom.
  - 15 ways to use games in the classroom. Using a game as the lesson because it teaches the content is only one way. While games can also be used as rewards, there are many other ways to use games.
  - 101 instructional strategies for using games in the classroom.
  - Annotated list of all games and software mentioned in the book.
- An extensive glossary of terms used in the book, including a quick look-up list of abbreviations.

What You Can Get Out of This Book

The design and analysis of educational videogames is a new and developing field. This book will be among the first of its kind.

This book will help you to:

- Evaluate existing digital games for learning to ensure that they will be a good fit.
- Form effective strategies for using existing games in learning contexts.
- Make better use of educational games built by others.
- Design innovative and effective lessons using games.
- Build better educational games.
- Create the right balance of fun and learning in a game.
- Evaluate proposed designs for games being built to help ensure the games will have the best chance possible of being effective and fun.

Conventions Used in the Book

New terms and important words are italicized the first time they are used. New terms can be found in the glossary. There are many terms that have no concrete meanings and many that get used in different ways by different groups. The glossary provides the definition of the word or phrase as it is used in this book.

Names of games are in *italics*. They are not always described in the main part of the text, but all of the games mentioned in the chapters can be found in Chap. 12. Each is listed with a brief synopsis and some additional details (free/for purchase, online/console/etc., ESRB rating, etc.)

Some abbreviations are used in the book. They are explained the first time they are used, but also appear in the glossary for easy reference.

Calgary, AB, Canada Katrin Becker

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> *"Not having heard something is not as good as having heard it; having heard it is not as good as having seen it; having seen it is not as good as knowing it; knowing it is not as good as putting it into practice."*
>
> *Xun Kuang, circa 200 BC*

At-A-Glance

Entire volumes have been written that are devoted to exploring what games are and yet we still have no definitive statement on the meaning of the word "game." You will find almost as many definitions of "game" as there are authors writing about it. There are some common elements though, and this chapter uses those to define what we mean by "game." In order to make effective use of games in the classroom we need to be able to choose appropriate games to use in our lessons. Evaluation is a key element of the development of instruction, and when using games, it is important to be able to assess its potential suitability before it goes into the classroom. We can do that using predictive evaluation, which is introduced here. Next we trace a brief history of games in society as well as in education, as games have been part of human society since ancient times, and there is evidence to suggest that one of the roles of games has always been learning. We've come a long way in our development of games, though digital games are more than a simple evolution of non-digital games, and the differences are outlined. The chapter concludes with a few more definitions so that we can all start on the same page.

Chapter Goals

- Define the term "game" as it will be used in the book.
- Explain how evaluation of games helps us choose better games for the classroom.
- Explain the four main time frames for educational evaluation.
- Trace a brief history of the cultural significance of games and their role in learning general and in formal education in particular.
- Describe the difference between traditional and digital games.
- Define the initial vocabulary that will be used throughout the book, such as learning, education, and serious game.

K. Becker, *Choosing and Using Digital Games in the Classroom*, Advances in Game-Based Learning, DOI 10.1007/978-3-319-12223-6_1

Key Terms

These are the terms introduced in this chapter. Definitions for these terms can also be found in the glossary.

- Analog Game
- Business Game
- Commercial Off-the-Shelf (COTS) Game
- Computer Game
- Computer-Mediated Game
- Computer Simulation
- Confirmative Evaluation
- Digital Game
- Digital Game Pedagogy (DGP)
- Digital Game-Based Learning (DGBL)
- Education
- Formative Evaluation
- Game
- Game for Learning (G4L)
- Learning
- Learning Object
- Model
- Predictive Evaluation
- Serious Game
- Simulation
- Simulation Game
- Summative Evaluation

1.1 What Is a Game?

"Game" is one of those words that's hard to define precisely in spite of the fact that everyone seems to be able to recognize a game when they see one, and virtually every human on the planet has played games at some point in their lives. Nonetheless, discussions that try to come up with a definition that is complete and upon which everyone can agree often descend into philosophical arguments. Is a game only a game while it is being played? If so, then what is it when it's not being played? Can anything become a game if we play with it a certain way? Can an object be a game, or can only an act be a game?

Wittgenstein said that there is no one feature common to all games but that there exists a certain family relationship (Wittgenstein, 1973). It is precisely this family relationship that we are seeking to define. Perhaps, as Huizinga (1950) also suggested, there are at least some distinguishing features that can be associated with most games even if all games do not share all the same properties. According to him, a game is "a voluntary activity or occupation executed within certain fixed limits of time and place, according to rules freely accepted but absolutely binding, having its aim in itself and accompanied by a feeling of tension, joy, and the consciousness that it is different from ordinary life" (p. 28). Clark Abt defined games as "an activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context" (Abt, 1970, p. 6). More recently, Kurt Squire suggested that the "accepted" definition of game breaks down in light of modern digital games in his thesis on the use of the game *Civilization III* in a grade 11 social studies class (Squire, 2003). Clearly, we could discuss this for a long time (many have) without coming to a real conclusion.

Although it is useful to look at how other scholars have defined "game," it is not necessary for our purposes to have a precise definition. However, we do still need to have some sense of what we are talking about. There are at least a few definitions of game that include the notion that it is a voluntary activity, but is this really necessary? Caillois said that a game we are *required* to play ceases to be a game (Caillois, 1961). In the case of educational games, we are often dealing with an activity that is not, strictly speaking, voluntary, so that doesn't help us.

1.1.1 Defining "Game"

First and foremost, a game must be interactive. If a player does not cause a change in the game by interacting with it, then it can't be a game; but, we also interact with toys, so what then distinguishes a game from a toy? Rules. A game must have some mutually agreed-upon rules and boundaries. That's not to say that games must always be social, although they often are, but it does mean that anyone playing this game will agree to some set of rules as outlined. There must also be some ultimate or intermediate goals to pursue. A game does not always need to involve conflict, but there does have to be some sort of goal, and the attainment of that goal must involve at least some challenge. *Animal Crossing* is a popular social simulation series where players take on the role of a resident in a small town. Players can choose from among many different activities; for example, they can develop the town by adding buildings and other structures, plant trees and flowers, go fishing, dig for fossils, and many other things. Even though this game does not have a definite ending, it is still considered a game as there are many intermediate goals that players may pursue, each of which involves one or more activities, such as paying off the mortgages on their house by fishing and selling the catch at the local store. Each intermediate goal has a definite ending as well as a quantifiable measure of success, and both are fundamental to games.

Where does that leave us? Based on the previous paragraphs and the various game definitions offered by others, we can now say that a *game*:

- Is interactive.
- Has rules.
- Has one or more goals.
- Has a quantifiable measure of progress (or success).
- Has a recognizable ending—usually.

This is good enough for our purposes. We will augment our definition somewhat when we look at the changes when we consider digital games specifically. For now, let's look at the role that games have played in education.

It is useful at this point to make a distinction between *learning* and *education*. Learning and education are two related but distinct terms. Learning happens all the time. It is what we as humans *do*. We can learn things that are good for us and bad for us, and we can learn things that are useful and useless. Education, on the other hand, is a culturally and societally defined entity. It is a subset of learning, to be sure, but education is value laden, while learning need not be. Learning of any form usually includes some sort of change in behavior or in what is known. Given that, it can be said that all games require learning, even if that learning has no use or value outside the game environment. Since most single-player games are designed to be self-contained, that is, to be playable (and winnable) without outside help, and since all games require learning, then it also follows that all games must teach. They are intended to be playable by a person who is alone and without help and so there must be sufficient information within the game itself to help the player get through to the end. This has implications for understanding games in a learning context. It especially has implications for approaches we might use to evaluate games.

1.2 Why We Need to Analyze Games

Merriam-Webster defines "media" as "a medium of cultivation, conveyance, or expression" (http://www.merriam-webster.com/), and by that definition stories qualify as media. In other words, we have been using media of various sorts to augment and enhance our teaching since our very beginnings. Stories were brought to life around ancient campfires with the skillful use of the teller's voice, sound effects, body movements, and sometimes props and firelight, and these stories were almost certainly used to teach as well as to entertain—in other words, stories may well have been the first educational technology. Although we have been concerned with learning and pedagogy since ancient times ("Education is the kindling of a flame, not the filling of a vessel."——Socrates), it has only been in the last 200 years (Bowen, 1972) that we have really begun to examine learning in a formal way, and of course it's only been since the 1980s that we've been able to use computer technology to teach. We have made a great deal of progress as far as designing and delivering authentic, meaningful education using technology, yet we continue to struggle to find effective ways to assess the value and efficacy of the technologies we use to deliver instruction. Many of the methodologies we employ to examine those technology-enhanced interventions look primarily at how the learner is affected or changed (Dick, Carey, & Carey, 2001; Pirnay-Dummer, Ifenthaler, & Spector, 2010), and this is very important, but as the design of instructional objects becomes more complicated and more expensive, it also becomes important to have ways of evaluating the object itself apart from the learner.

Given what's at stake when deciding on a technology to use in the classroom, it would be very helpful to be able to assess a *learning object* while it is still in the design stages, and with more and more ready-made objects available to choose from it would also be worthwhile to have a methodology that can be used to create a short list from among a number of candidates. Although there is no shortage of resources on how to design and build digital educational applications, approaches to their evaluation are far less plentiful (Schleyer & Johnson, 2003). This is especially true of interactive objects, such as games.

Digital games are among the most highly interactive digital media currently known, and this sets them apart from other media. In fact, games are distinct from all other digital and mass media. They share qualities with many other media forms to be sure, but they also have other qualities that set them apart (Egenfeldt-Nielsen, 2004). For one thing, people proceed in games by *doing* things, and the state of the game changes in response to the player's actions. This experiential quality lies at the very core of game design: a game is not a game if there is no interaction. What does that mean? Something that is interactive means that the environment *must change as a result of player actions*. This results in various experiences for the player, and videogames are popular precisely because of the experience they provide. Games designed for learning can do no less, but unlike games intended purely for entertainment, games for learning (G4L) must also do more. They must teach something, and therefore we must also find ways of determining if they are likely to be effective. This is typically done through some form of evaluation.

Evaluation plays an important role in the development of instruction generally, for without it we have very few ways of knowing if what we are doing is working, and when it comes down to it, there's really no point in doing any of this if it isn't working, and there's little point in trying something if we don't at least have some confidence that it is likely to work. Given that there are a number of different ways to approach evaluation. If we group evaluation activities based on when they typically occur, it becomes possible to group approaches to evaluation into the following four categories:

- *Predictive*
- *Formative*
- *Summative*
- *Confirmative*

The most commonly seen forms of evaluation in education are of the formative and summative variety. Although there is sometimes confusion about the distinctions between formative and summative evaluation, Robert Stakes has offered a simple way to distinguish them: "When the cook tastes the soup, that's formative. When the guests taste the soup, that's summative" (Scriven, 1991) p.19. Thus, formative evaluation tends to focus on the process and normally takes place before the intervention has been deployed, while summative evaluation normally takes place after deployment and focuses on its overall effects. Confirmative evaluation is less commonly seen in formal education, possibly for practical reasons. It is normally performed after the summative evaluation has been complete for some time, and its

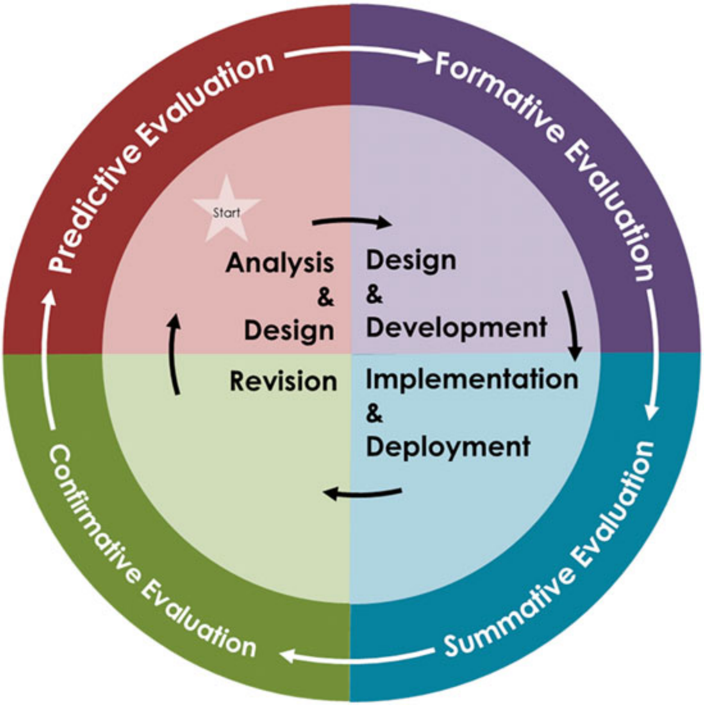

Fig. 1.1 Forms of evaluation

purpose is to confirm that the instruction is still effective weeks, months, and even years later. Predictive evaluation takes place before the instruction is developed. Figure 1.1 shows the relationships of the different forms of evaluation to the various stages of the instructional design and development process.

All four forms of evaluation are important, although confirmative evaluation has a tendency to be overlooked, and predictive evaluation is relatively uncommon, especially in formal education. However, as educational software and other digital instructional materials become more complex, the amount of institutional and human resources needed to make optimal use of these materials grows as well. The ability to evaluate software *before* it gets adopted could be very beneficial. This is a form of predictive evaluation, and it is the kind of evaluation we will cover in this book. It provides us with a way of examining and evaluating a game *before* we have invested a great deal of time and effort, and well before we have subjected our students to it.

1.3 Why Games?

Many claims have been made that play and games are "natural" ways to learn (Rieber, 1996). We do seem to come by it naturally. We know that many animals play, and we are also discovering that play is an essential developmental activity for most young animals, but some seem also to play actual games. One only has to watch two dogs at play to know that this is true. While their play may not meet all of the requirements for a game that we have outlined, it is clearly more than simple free play, as there are rules and intermediate goals, such as knocking your opponent off balance, or getting the stick, and thereby becoming "it." Interestingly, when dogs are play-fighting, they exhibit almost all of the same behaviors they would when fighting for real. They growl, bite, and bare their teeth. There are some key differences though—the secondary physiological reactions that are normally seen during aggression are absent in the game (like the hair being up on their backs), and the normal dominance hierarchies are not enforced (a subordinate dog can "best" a superior dog in play without retribution). If you've spent any time watching dogs play, you will also have seen times when the magic circle is broken (someone breaks a rule) and suddenly it becomes serious. The growling changes, their postures change, the hair goes up, etc. and a whole new set of rules come into force, for now this is no longer a game. Among humans and animals alike, games can serve as mechanisms for learning, but for us humans, games are even more than a way for our youngsters to learn. Games are a part of culture.

1.3.1 Games in Society

There is reason to believe that games have in fact played a significant role in the evolution of human culture as well as cognition (Murray, 2006). We share an ancestry with the apes; yet by almost any measure we are both smarter and more sophisticated. Why is it that we are so much more advanced than our closest relatives, culturally speaking? Michael Tomasello (1999) has theorized that one of the most significant developmental steps has been our ability to understand fellow humans as intentional agents. It is what underpins symbolic communication (which includes, but is not limited to, language), which in turn facilitates cultural learning. He believes that culture ratchets cognition—that our brains and our culture co-evolve. In other words we are advanced because of the cultures we have developed, which in turn provide the scaffolding necessary to allow to develop even more sophisticated cultures, which in turn allows us to advance further still. Another piece of this puzzle is provided by the Canadian cognitive neuroscientist Merlin Donald. According to Donald (2001) human cognition developed in four stages:

Episodic culture which is where the apes still are (episodic culture is one that lives "in the moment").

1. Mimetic culture (see next paragraph) which is a pivotal for cultural development[1] and includes symbolic communication involving *mimesis*.

Mythic culture which is narrative and includes oral language, rituals, and cave paintings, and finally, where we are now.

[1] It is at this stage that learning and reinforcement took the form of direct instruction, reciprocal games, and group ritual, "a collective act in which individuals play different roles" (Donald, 2001).

Theoretical culture which includes an understanding of the world in abstract terms and is based on externally stored memory systems.

Mimetic culture is all that is required for the development of games. Mimetic skill constitutes the primary missing link between ape and human culture. In contrast to episodic skill "mimetic skill rests on the ability to produce conscious, self-initiated, representational acts that are intentional but not linguistic" (Donald, 1991 p.168) and this skill underpins games. Although he did not examine games explicitly, Donald does suggest that the progress of hominid cognition parallels the progress and complexity of our game forms.

Games are an inherent part of culture, and an innate activity for mankind. Games are part of who we are, so it seems natural that we would also use games to teach.

1.3.2 Games in Education

Although we have probably been using games to teach for thousands of years, the first organized efforts in formal training are thought to have begun around 1780 with Helwig's Game (Egenfeldt-Nielsen, 2005). Militaries throughout the Western world have been strong supporters of the use of digital games for teaching everything from skills to tactical and strategic to peacekeeping. We do not really know how successful these efforts are because gaining access to their findings from studies w.r.t. effectiveness is difficult. However, the sheer size of the investment and the fact that the use of games for learning (G4L) continues to grow are good indications that they are having enough success to justify their continued use. Business colleges, especially in America, have also used simulations and games as educational technologies for some time but this has not influenced educational gaming outside of business schools until quite recently.

Elsewhere in formal education, games did not start to become popular until the middle of the twentieth century. At that time, Johan Huizinga published his study on play, *Homo Ludens* (Huizinga, 1950) where he claimed that play was a necessary cultural activity. Jean Piaget also made connections between learning rules in games and the development of moral judgment (Piaget, 1951). Shortly after, the RAND corporation published a report that made broad claims about the value of games in education for increasing engagement: "A virtue of gaming that is sometimes overlooked by those seeking grander goals is its unparalleled advantages in training and educational programs. A game can easily be made fascinating enough to put over the dullest facts. To sit down and play through a game is to be convinced as by no argument, however persuasively presented" (Mood & Specht, 1954). It would appear that this is where the idea came from that games can be wrapped around "dull facts" in order to make them more palatable. This is a myth we are still battling today.

Business colleges have been running *business games* for decades, and live action *simulation games* were used in education long before the computer. Like games generally, simulation game is a term that does not have a single, precise definition, but most would agree that includes aspects of both games and simulations. In education, a simulation is seen as a representation of a reality. This is a much narrower definition of simulation than that accepted by the computer simulation community, who define simulation as a computer implementation of a mathematical or an abstract model. The requirement of reality is not present, and as we shall see, this seemingly small difference can have a profound effect. In education, simulation games are usually role-playing games, where the chief focus is on the interactions of the players (Dorn, 1989).

Both business games and educational simulation games have had an influence on attitudes towards the use of digital games in education. Margaret Gredler, the author of the chapter on simulations and games in the first two editions of the AECT Handbook of Educational Technology, said that digital games are an evolution of traditional games presented using modern technology (Gredler, 1996), but they're really not. They are related though, so it's worth looking at how.

To do that, we need to define a few terms.

1.3.3 Talking About Games

Before we can take a detailed look at how game-based learning and pedagogy work, we must first clarify what we really mean by these terms. Definition wars are common in many disciplines, and they are even more common in a field as interdisciplinary as games for learning (G4L). In the end though, it is less important that everyone agree on a single definition than that we understand what we mean when we use the various terms. The following are how we will use the terms in this volume.

1.3.3.1 Digital vs. Analog

Digital things are those that are represented in one way or another as binary digits. This includes everything from the text of this book as it was entered on the author's computer, to an image stored as a jpeg, a song stored as an mp3 file, or a 3D movie stored on a DVD. All digital entities are, by necessity, discrete. Each value or sample can be represented by a number, and that number represents in a sense a snapshot of that entity in a given place and at a given time. Analog entities, on the other hand, are continuous, and include the majority of the natural world. For example, real numbers (i.e., those with decimal portions) are continuous, and there are an infinite number of values between 2.0 and 3.0. Sound in the natural world is continuous, from the songs on a vinyl record to the pencil notes on a piece of paper played by an orchestra. When it comes to games, one that exists outside of the computer, such as a board or card game, is an *analog game*. A *digital game*, by contrast, is one that exists in the computer. While there is some overlap, going digital changes things.

1.3.3.2 Game vs. Simulation

Is the object we plan to use a game or a simulation? Are digital games more like traditional board games, face-to-face play, theater, or something else? Is "serious game" a misnomer? Does it matter? It may seem that words should not be so important, but the way we delineate the borders defining what is and is not a game has implications for research and development, as well as for how it might be used in the classroom. A definition that is too broad, such as one that implies anything we treat as a game, becomes one is not useful, and a definition of game that is too narrow, such as one that implies that all games must have competition and that winning in games is always more important than exploration, excludes development choices that might otherwise be beneficial. Since we have already come up with a working definition for "game," let's look at simulation. A *simulation* in the general sense is "a representation of the features and behaviors of one system through the use of another" (Thiagarajan, 1998, p. 35). A *computer simulation* is an implementation of a model, and a *model* is a consistent representation of some system. That model does not need to represent reality; it merely needs to describe a system in a consistent way. We could, for example, describe a world of fairies and wizards, and so long as all of our variables and behaviors were consistent with each other, and so long as the interrelationships between all the elements of our world worked together, we could create a computer simulation of that world. In other words, so long as the model is sound, we can simulate it.

1.3.3.3 Computer Game vs. Computer-Mediated Game

It is important to separate "pure" digital games from digital versions of non-digital games, as they are distinct. The differences may not be important to players of these games, but they are important to the designers and developers, and that has implications for us if we want to use these games in classroom settings. Some games can only exist as computer games, such as *Tetris*, *Super Mario* (*NSMB*), or *Katamari Damacy*, while others are merely digital versions of traditional games, such as Solitaire and chess. *Wii Sports* is part simulation of the real sports they represent, part something else. *Games for Learning* (*G4L*) can include both "pure" computer games and computer-mediated games, but the applications for these games are often different, as will be seen as we begin to analyze a few.

1.3.3.4 Digital Game-Based Learning (DGBL) vs. Digital Game Pedagogy (DGP) vs. Gamification

Let's get one thing out of the way right here and now. Game-based learning and gamification are not the same. Digital game-based learning is learning that happens with the help of digital games. This could involve learning by playing games, but it can also involve learning through building games. DGBL uses complete games, usually within a larger learning context. Gamification, while related, is the use of game design *elements* (as opposed to entire games) in a non-game context. This book is not about gamification, but it is important to distinguish between the two as they involve substantially different approaches. DGBL builds learning around whole games, while gamification uses aspects of games and incorporates that into a learning intervention as part of it. The third term, digital game pedagogy, is a term not commonly used, but it will be used in this volume and is intended to highlight the distinction between *learning* with games and *teaching* with games. The two terms are closely related but are effectively opposite sides of the same coin—one from the perspective of the learner and the other from the perspective of the teacher.

1.3.3.5 Serious Game

A *serious game* is a digital game designed for purposes other than or in addition to pure entertainment. While some entertainment games are often used as educational games, such as Sid Meyer's *Civilization*, it is the designed intent that classifies a game as serious. Games like *Civilization* are games used for serious purposes, and although as we shall see these games can have worthwhile applications in formal education, the fact that they were not designed as serious games puts them in a different category when it comes to designing lesson around them.

1.3.3.6 Commercial Off-the-Shelf Games

Civilization is a commercial off-the-shelf (COTS) game. These games are produced first for commercial purposes and sold largely through commercial retail outlets. Some *COTS* games have been used quite successfully in learning situations, such as *Minecraft* and *Gone Home*, in which case they could be referred to as games used in serious contexts, but they are still commercial games.

Where does that leave us? Figure 1.2 provides a simple grouping of various types of games, so we can see some of the relationships. This grouping is not definitive, but it will help us to get a handle on some of the differences, so we can begin to see potential applications along with potential limitations for these games. With a few exceptions, most entertainment games are not of interest to us for classroom use. These are only shown for completeness, and most fall in the category of "pure" computer games. Some games are played only in real life. These are the analog games and include board and card games, sports, *role-playing games* (*RPG*), and *live action role play* (*LARP*). Some of these can be played on a computer but are really computer simulations of the analog game, such as *Solitaire* or *Jeopardy*. We call these *computer-mediated games*. Some games can only be played on the computer.

Serious games include some purely digital games like *Food Force*, but they also include computer-mediated games such as computer versions of traditional educational simulations, business games, and drill and practice games. MMORPGs (Massively Multiplayer Online Role-Playing Games, sometimes just shortened to MMO) share a common ancestry with RPGs and LARPs but are not simply

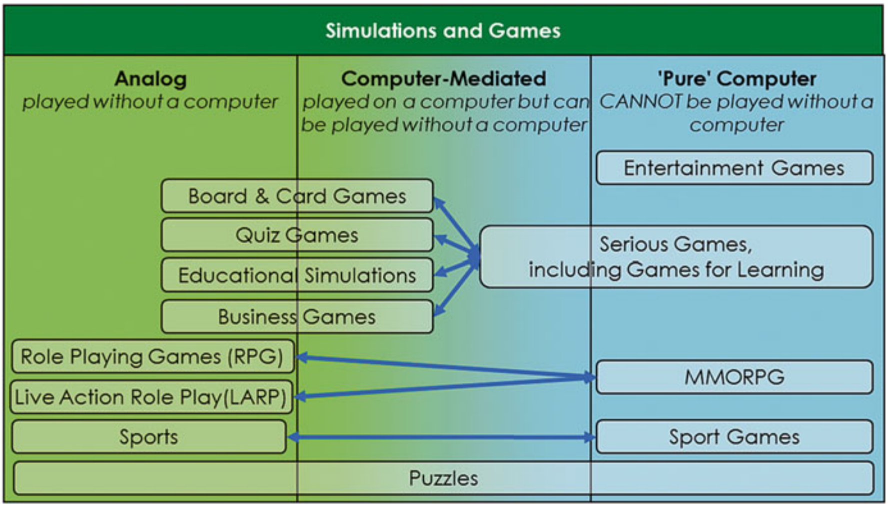

Fig. 1.2 Relationship of analog, computer-mediated, and "pure" computer simulations and games

computer-mediated versions of the analog game. LARPs go back a long way and include re-enactments of historical events as well as fantasy play which became popular in the 1960s. The first modern RPGs (such as Dungeons and Dragons) appeared in the 1970s, and no doubt they were influenced to some extent by LARPs. The first MMOs appeared in the mid- to late 1990s. In the beginning the MMOs did look very much like computer versions of RPGs, but over time, all three have continued to evolve into distinct activities. Because of this, Fig. 1.2 shows MMOs as beginning to be connected to both LARPs and RPGs, but they are distinct. All have continued to evolve since their beginnings and MMOs now exist as a pure computer games, while the other two remain as analog games.

When it comes to sports, real-life (RL) sports and computer sports games are also related to each other but they are not simply computer-mediated versions of the analog game. For one thing, it is possible to play computer soccer alone since all but one of the players are controlled by the game. Here again, while there is a strong connection between RL and computer sports games, the computer version is not simply a simulation of the RL game as is the case with something like *Solitaire*.

Puzzles are among the few classes of games that exist in all three forms. There are plenty of examples of puzzles that have been simulated on the computer, such as *Sudoku* or crosswords, making them computer-mediated games. There are also a great number of puzzles that can not exist in real life and can only exist as "pure" computer games, such as *Tetris* or *Bejeweled. Monument Valley* is another example of a puzzle game that cannot exist in real life. It is a puzzle game that uses ideas from Escher's drawings, requiring players to defy the laws of physics in order to create pathways along which the small traveler can pass.

Although the "landscape" changes rapidly in the field of digital games both in the areas of development and research, the same is not true of traditional games—new non-digital games are still developed, but the area of research is far less active and its influence on digital gaming is more of a historical one than an ongoing pressure. Digital games do still share some commonalities with traditional games, but they are now more than that.

1.3.4 Going Digital

With the development of the personal computer in the 1980s, schools began to include digital games as part of their learning technology repertoire. Some refer to the 1980s and 1990s as the "Edutainment Era" and it followed the typical Gartner Hype Cycle to a tee (see Fig. 1.3), except that in this case "trough of disillusionment" became a deep chasm, and games became a pariah, both in education and in the games industry. During the Edutainment Era, the business of educational games became a $500 million market, and the largest educational software company was also the second largest software company, second only to Microsoft. By 2004, the majority of the educational software companies had disappeared, and sales had plummeted (Shuler, 2012). Part of the problem was that educational games were being sold by major retailers who demanded that prices be kept low, but another big part of the problem was that with very few exceptions, the games that were being designed could not live up to the claim alluded to by RAND in the 1950s. Most of the games designed simply weren't very good. Even though the commercial games industry was already well on its way when it came to learning how to design a game experience that would sell, educational game designers did not seem to be following the same path.

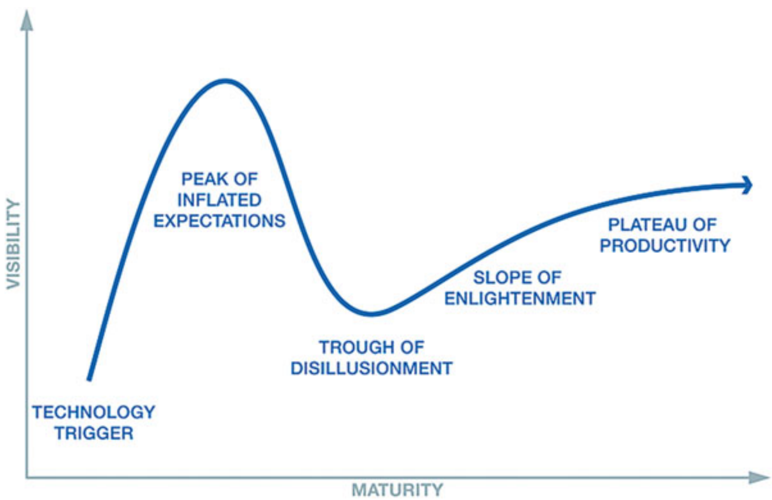

Fig. 1.3 Gartner Hype Cycle (used with permission) (Gartner Inc., 2014)

The 1980s were an exciting time in both technology and education. Seymore Papert had published his seminal book, Mindstorms (Papert, 1980), that outlined the incredible potential computers had for use in education. Personal computers were making their way into classrooms, and various researchers were beginning to explore the potential of computer games for learning (G4L). Thomas Malone identified the four fundamental elements that must be present in the right amounts in a game to make it fun: challenge, curiosity, fantasy, and control (Malone, 1981). Educational technology had become an active field, and various noteworthy publications impacted how educators viewed computers and games. Stephen Alessi and Stanley Trollip published the first edition of their book, *Computer-based Instruction: Methods and Development* (Alessi & Trollip, 1985). In it, they expressed optimism over the possibilities for both computer simulations and games, which they described as being quite similar which they claimed could sometimes be better than the real world. Games were claimed to be powerful learning tools that increase motivation and focus. They also wisely noted that when it came to design, it wasn't the game (which they described as the wrapper) that made it effective, but that it was the challenge. By the late 1980s the edutainment industry was thriving. This was the era that produced such noteworthy titles as *The Oregon Trail* (1985), and *Where in the World is Carmen Sandiego?* (1985), but these were primarily sold for use in the home, and the use of games in the classroom was still not common. Unfortunately, many educational games designed for use in schools were often little more than wrappers around preexisting educational content. Many educators of the time believed that digital games were simply an evolution of traditional games being delivers using modern technology (Gredler, 1996). Some still believe that now, but the truth is that while they are both game forms, with the exception of puzzle games and *computer-mediated games*, digital games have much more in common with film than with board games. Computer-mediated games are those that have versions that can exist apart from the computer, such as *chess*, *solitaire*, or *Jeopardy!*.

The edutainment industry continued growing in the 1990s and there were many small independent developers, many of which were acquired by larger companies. Alessi and Trollip came out with a second edition to their computer-based instruction text, in which they added new accolades for both simulations and games. Simulations were said to be better than tutorials and drills for learning, and games provided entertaining challenges. They also noted that games may or may not simulate reality, which diverges from the definition of games offered by Gredler. On the one hand, there was considerable optimism. A white paper published in 1993 claimed that "(d)espite all the talk about education and computers, the educational software revolution has yet to begin" (De Laurentiis, 1993, p. 2). In reference to educational technology generally, it was claimed that "(d)espite its promise and the vision of many futurists, technology has yet to make its mark on education" (De Laurentiis, 1993, p. 9).

At the same time, Richard Clark published his rebuttal to Robert Kozma's claims about technology affecting learning. Clark's position was that media would never influence learning, and argument he first published in 1983. 1994 marked the second volley in the "Clark-Kozma Debate." This is a fundamental argument in educational technology, and worth a closer look, so we will do that in the next chapter.

It was at this time that the Association for Educational Communications Technology (AECT) published its first edition of the Handbook of Research on Educational Communications and Technology, and Margaret Gredler did the chapter on games and simulations (Gredler, 1996). In it, she distinguished between games and simulations in the following way:

Simulations:

- Must be complex and REAL (referred to as fidelity or validity)
- Participants have defined roles
- Data-rich environment, where students can execute range of strategies
- Feedback is in the form of changes to situation
- Learning model is educational objective
- Understanding the model is the goal

Games:

- Learning embedded in game, not part of it
- Has rules, winning is important
- Winning should not have random factor
- No distracting bells and whistles
- Include directions in booklets
- Students shouldn't lose points when wrong
- Games rarely played differently from the way they were intended
- Winning will take precedence over experimenting
- Games are less efficient learning models than other methodologies
- Educators have negative beliefs about games

This volume was quite influential in educational technology research and may well have influenced the ways subsequent educational games were developed. The educational games industry was significant at the time, and by the late 1990s The Learning Company was second only to Microsoft as a consumer software company. Edutainment came to be sold through mass markets, and unfortunately retailers wanted only to deal with big companies. Mass markets translated into mass production, and the small companies couldn't compete. Prices and profits were low, and this ultimately also affected perceptions of value. In the end, the games could not live up to the hype.

The turn of the century saw the collapse of the dot-com bubble. Software companies lost their shine and with them edutainment. Alessi and Trollip produced the third edition of their multimedia text, which had changed its name to Multimedia for Learning: Methods and Development (Alessi & Trollip, 2001). Their chapters on games and simulations reflected the general trend and had become less enthusiastic about the potential of games and simulations. They now warned that these were the most challenging of all methodologies to design. In order to succeed, one needed to know content, learners, many complexities, and sophisticated programming. Games were also said to be hard to make, and those that were available were described as containing mostly repetitive practice.

By 2004 the Edutainment industry had also crashed (Shuler, 2012) and it appeared that formal education was distancing itself from the use of games as learning tools. In the second edition of the games and simulation chapter in the AECT Handbook of Research on Educational Communications and Technology, Gredler continues to emphasize distinctions between games and simulations (Gredler, 2004) with simulations being good, and games less so. Simulations are said to be of real-world situations, and games are supposed to be designed such that players do not lose points for wrong answers, they should be free of distracting sound and graphics, lest the player be encouraged to follow a more interesting wrong answer rather than the right one. Further, games should permit multiple winners rather than only one. The underlying message here is that games should not encourage exploration (presumably that's what simulations are for), and they should not encourage transgression, both of which are essential to play. Presumably, fun and education did not mix.

On the other hand, the serious games initiative, founded by Ben Sawyer, was building momentum (Sawyer, 2003), so while formal education still appeared to be actively rejecting games for learning, an increasing number of other sectors such as the military, health, and social justice were doing just the opposite. This was also around the time that the online world was changing into a place where people could socialize and spend quality leisure time. Second Life, the online virtual world, was launched in 2003, Facebook and World of Warcraft were both launched in 2004, and the Web became a social space.

Over the next few years we begin to see the attitudes towards the use of games in formal education begin to turn around again, with some noteworthy bumps in the road. The Richard Clark attempted to resurrect his debate by publishing an attack on serious games in 2007. In it, he reprised his claim that media do not influence learning (Clark, 2007) (see the next chapter for more on that). By the time we get to the third edition of the AECT Handbook of Research on Educational Communications and Technology (Spector, Merrill, Merrienboer, & Driscoll, 2008) the apparent abandonment of simulations and games as learning technologies is evident: there are no chapters on games or simulations at all, but there is one on "modeling technologies" which is really just simulation hiding under a different name.

1.4 Games Now

Things have changed. Again.

The fourth edition of the AECT Handbook of Research on Educational Communications and Technology no longer has a chapter on simulations and games (Spector, 2014). Instead there are numerous chapters on something called "modeling-based instruction," which seems to be a new name for simulation, and "immersive simulations," which are also simulations, and finally one on "game-based learning," which seems to lump games and simulations together.

There is a rising acceptance of the claim that digital games can have a positive effect on learning, and that the medium of the videogame has a useful role to play in formal education. Evidence that this is more than just a claim is mounting (Clark, Tanner-Smity, & Killingsworth, 2014). A 2014 report on teachers using games in

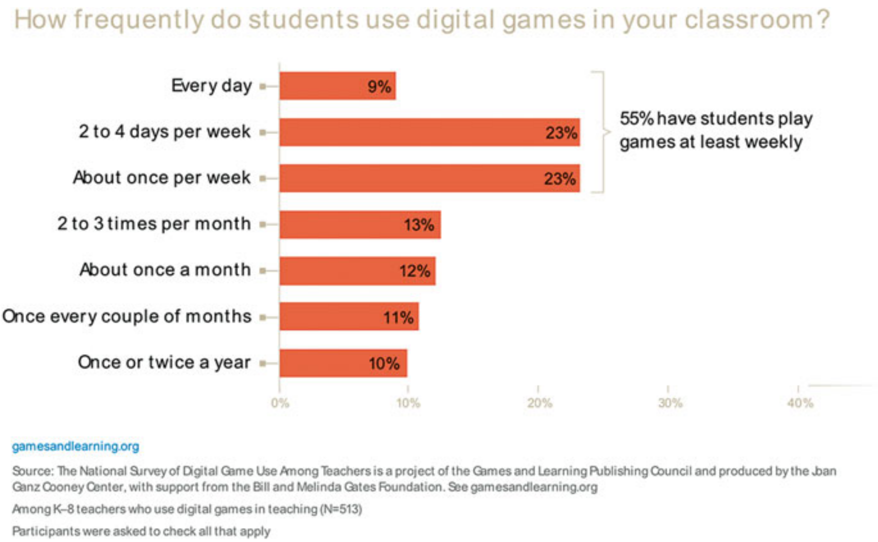

Fig. 1.4 Use of games in the classroom (Takeuchi & Vaala, 2014)

class indicates that slightly more than half of American teachers are now using games in class at least once a week (see Fig. 1.4). Approximately a third of that use happens individually, and another third in small groups of 2–5 (see Fig. 1.5), and nearly three-quarters of them use PCs. Interactive whiteboards remain popular (41 %), but the use of tablets is also becoming more common (39 %) (see Fig. 1.6). Digital games:classroom, students and devices

A 2014 meta-analysis found that using games had, on average, better learning effects when compared against non-game conditions (Clark et al., 2014). However, the design of the game remains crucially important, and the same study found that the design of the intervention had as much effect as the medium. From this, we can conclude that while games for learning (G4L) *can* be valuable in formal education, this is only true if the games are well designed. Unfortunately, with the popularity of G4L rising again comes the increase in the number of groups creating those games, and with that comes the inevitable increase in poorly designed games. Being able to assess a game's design before it gets used in the classroom has never been more important.

1.5 Summary

Games have been part of human society for a very long time. Animals use play and games as a way to teach and train their young, and it seems natural that we would do that too. However, other than at the lower elementary levels the use of games as learning technologies has not been common. Games are often seen as frivolous and

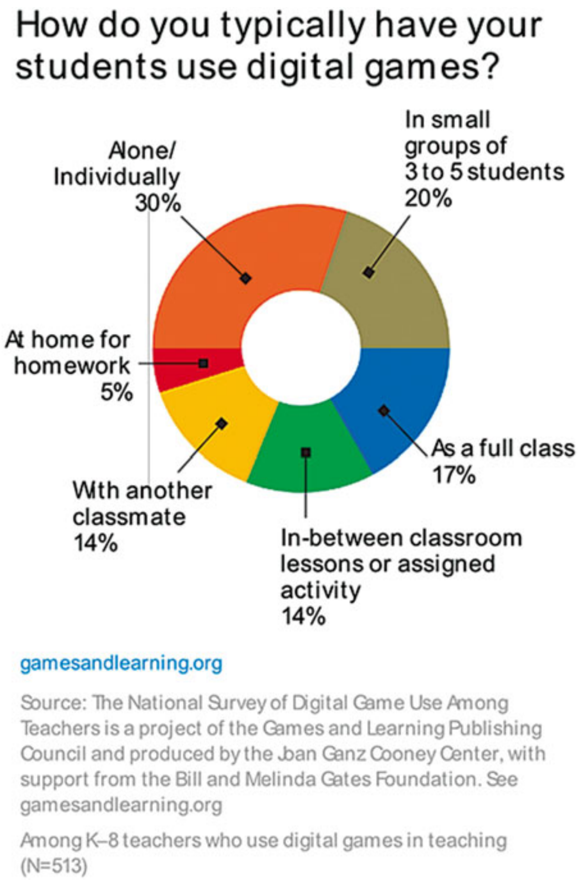

Fig. 1.5 How students use games (Takeuchi & Vaala, 2014)

therefor inappropriate, but if we view games as media for communication and expression, then we can look at games as a tool we can use in the classroom. In order to do that well, we need to be able to examine and assess games for their potential value in a classroom setting. A precise definition of "game" has proven to be elusive, but most can agree that games include at least these properties. A game:

1. Is interactive.
2. Has rules.
3. Has one or more goals.
4. Has a quantifiable measure of progress(or success).
5. Has a recognizable ending—usually.

In order to make the best possible use of the often limited resources we have in the classroom we need to be able to evaluate those resources before we invest in them. There are many ways to approach evaluation of learning interventions. The ones that most of us are familiar with are formative and summative evaluations, which are typically used during development and after deployment. The one we will

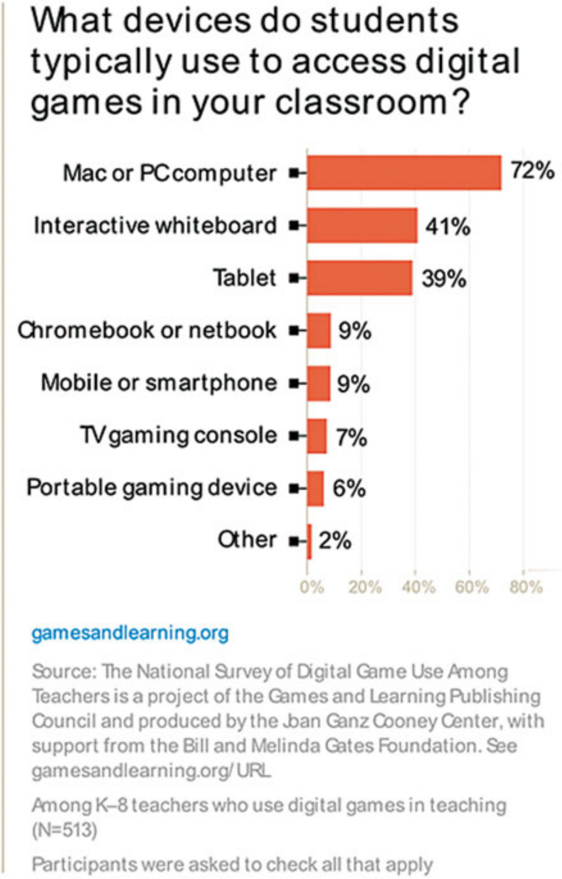

Fig. 1.6 Devices (Takeuchi & Vaala, 2014)

use is predictive analysis, which will help us choose appropriate games for use in the classroom before we build our lessons. This allows us to narrow our choices to only those games that have a high likelihood of meeting our needs.

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Chapter 2
Digital Game-Based Learning: Learning with Games

"(T)he central point of education is to teach people to think, to use their rational powers, to become better problem solvers."

Robert Gagné (1980, p. 85)

At-A-Glance

This chapter on game-based learning and the next on game-based pedagogy form the foundation on which the remainder of the book is built.

In this chapter we see why all games involve learning. We highlight some of what is currently known about games and learning including the arguments in favor (attraction, flow, engagement, etc.) by going through the motivation and learning theories that connect most closely with games. We examine the Clark–Kozma debate through the lens of games as educational technology to better understand why some remain resistant to the use of games for learning. We also look at some of the challenges to using computer games in the classroom, for instance the lack of access to technology, lack of institutional support, funding, access to good games, etc.. We will explore the things that make games unique as a medium, and as a learning technology such as the fact that rule systems and enforcement tend to be hard-coded in games, whereas they are personally or socially mediated in traditional games. In games, players can take risks and explore "what if" questions that might be too dangerous, or risky in real life. We conclude with a brief examination of the place games have in media literacy.

Chapter Goals

- Explore the learning theories that have formed the foundation for digital game-based learning.
- Connect the dots between theories of learning and the design of good digital games.
- Review the Clark–Kozma Debate and see how games fit in.
- Consider how it is that all games can be said to teach.
- Identify some of the advantages and challenges in using games for learning.

K. Becker, *Choosing and Using Digital Games in the Classroom*, Advances in Game-Based Learning, DOI 10.1007/978-3-319-12223-6_2

Key Terms
These are the terms introduced in this chapter. Definitions for these terms can also be found in the glossary.

- Activity theory
- Actor–network theory
- Attribution theory
- Behaviorism
- Classical conditioning
- Cognitive apprenticeship
- Cognitive development
- Cognitive load theory
- Cognitivism
- Conditions of learning
- Connectionism
- Constructionism
- Constructivism
- Digital game-based learning
- Digital game pedagogy
- Direct instruction
- Discovery learning
- Experiential learning
- Flow theory
- Humanism
- Instructionism
- Learning theories
- Maslow's hierarchy of needs
- Operant conditioning
- Scaffolding
- Schemas
- Self-determination theory
- Situated learning
- Social constructivism
- Social development theory
- Social learning
- Social learning theory

2.1 Theoretical Underpinnings of DGBL

Digital game-based learning (DGBL) is often defined as including everything that has to do with teaching and learning using games, but games for learning should really be viewed from at least two perspectives. One is the perspective of the learner, which considers how people learn from games, and the other is the perspective of the

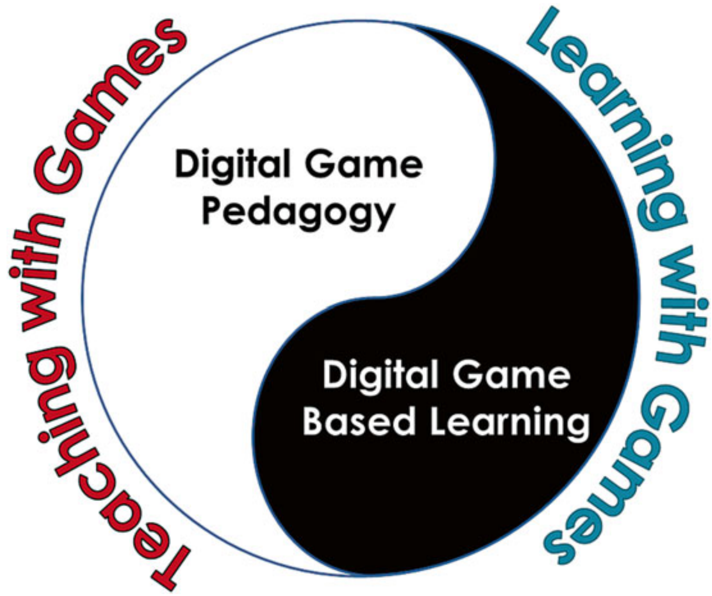


Fig. 2.1 Relationship of game-based learning and pedagogy

teacher, which looks at how we can teach with games. In this book digital game-based learning is used to describe the first perspective, and the second is called *digital game pedagogy* (DGP). Like the philosophical Yin–Yang concept, game-based learning and pedagogy are interrelated and complementary (See Fig. 2.1). The traditional associations with the white Yang character are thought to be active and masculine while black Yin character is thought to be feminine and passive. While these stereotypes don't really apply to teaching and learning, the notion that both sides complement each other in a way that makes the whole greater than the sum of the parts is quite useful. It underlines the fact that teaching and learning are equally important parts of a greater whole while at the same time reminding us that the theoretical underpinnings are different. One (DGBL) grows out of learning theories while the other (DGP) is influenced by instructional theories. There is some overlap, but we will examine both separately as far as is possible. This chapter tackles the first perspective.

A report produced by the Federation of American Scientists in 2007 suggested that "research on games in education should be a part of a coherent research program in learning science and technology" (Federation of American Scientists, 2006, p. 7). What have we learned since? We can answer this question by looking at learning theories that relate to games. *Learning theories* consider how the existing conditions of a person and their environment interact with the psychological and physiological functioning of the human mind and body (methods) to bring about a change in that person's worldview, behavior, and/or skills (outcomes). In other words, learning theories attempt to explain how people learn (See Fig. 2.2). There are a number of established theories that can help us understand why and how

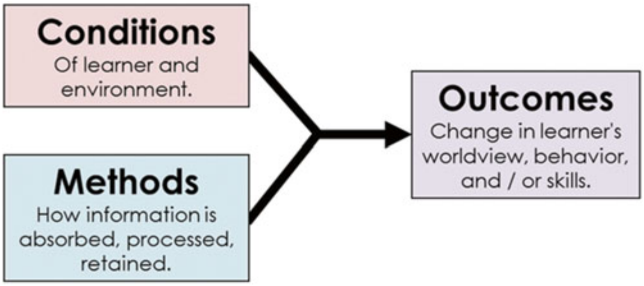


Fig. 2.2 Learning theories

learning happens in games. None of these can be transformed into a prescription for how to make a perfect game, but these theories do help us to examine games from the perspective of the player, and they also help us to understand the mechanisms that play a role in how games facilitate learning. Further and perhaps more relevant for us, they can help us to determine which kinds of games are most likely to be suitable for our purposes in a given situation. For example, suppose we are teaching a unit on animals. By understanding the ideas behind the theories we will learn why a game that is designed using a *behaviorist* theory such as *direct instruction* is unlikely to be useful if your objective is to encourage respect for living things. It might, however, be useful in a different unit if the objective is able to identify an animal's place in the food chain.

2.1.1 Learning Theories

What theories and models underpin educational game design and use? In their meta-analysis of studies on the learning theories that were claimed to be foundational to digital game-based learning, Wu et al. found that there were quite a variety of learning theories included (Wu, Hsiao, Wu, Lin, & Huang, 2012). These were grouped into four categories which included behaviorist, cognitivist, humanist, and constructivist approaches. Their original list formed the basis for the list shown in Fig. 2.4 which is divided into five categories as shown in Fig. 2.3. Several of the learning principles from Wu's original list have been reordered, and there are a few additions including the social learning category as originally described by Merriam and Caffarella (Merriam & Caffarella, 1999) along with several key motivational theories (Siang & Radha Krishna, 2003) which have been grouped in the humanist category, as they all relate to affective aspects of learning. This list is in no way intended to be exhaustive, and some theories that would normally be included have been omitted as they have significant overlap with one or more that are already here. Note that a number of theories are connected to more than one category, and it's very likely that there are some whose memberships in one or another category could be debated at length. The divisions are not meant to be definitive, but rather

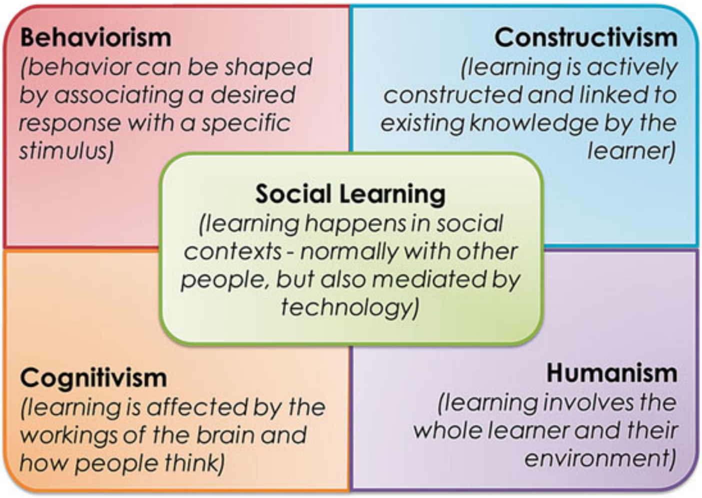


Fig. 2.3 Categories of learning theories

to form a functional guide. The goal is to provide a way to think about learning theories that is not too onerous so that they can be applied to the ways in which games can foster learning.

This section will briefly explain each of the theories in Fig. 2.4, and outline how it connects to DGBL. Let's first look at the major categories and how they differ. *Behaviorism* and *humanism* can in some sense be seen as representing opposite ends of a spectrum or as opposing sides of a coin. Behaviorist theories are primarily theories of external motivation that comes in the form of reward and punishment. By contrast, humanism is a paradigm of learning that centers on self-actualization and takes a more holistic approach.

In between we have *cognitivism*, which is based on attempts to understand how we learn rather than why and posits theories based on such things as how we process information and how we make meaning of our world. Included in this category are such concepts as schemata (mental models), and cognitive load theory. These concepts also play a role in DGBL.

Also between behaviorism and humanism are *social learning* and *constructivism. C*onstructivism is described as the process by which the learner constructs knowledge and meaning through the interaction of their ideas and their experience. It is considered to be a more indirect approach than one that involves simply telling the learners what they need to know, and it is the approach favored in many descriptions of what's needed to develop twenty-first-century learners. The kind of learning that occurs in most games (drill and quiz games excepted) is almost always constructive, at least in part. Social learning highlights the fundamental role that communities and other people play in the learning process. It could be argued that the social learning really encompasses aspects of both cognitivism and constructivism, only enacted in a social context.

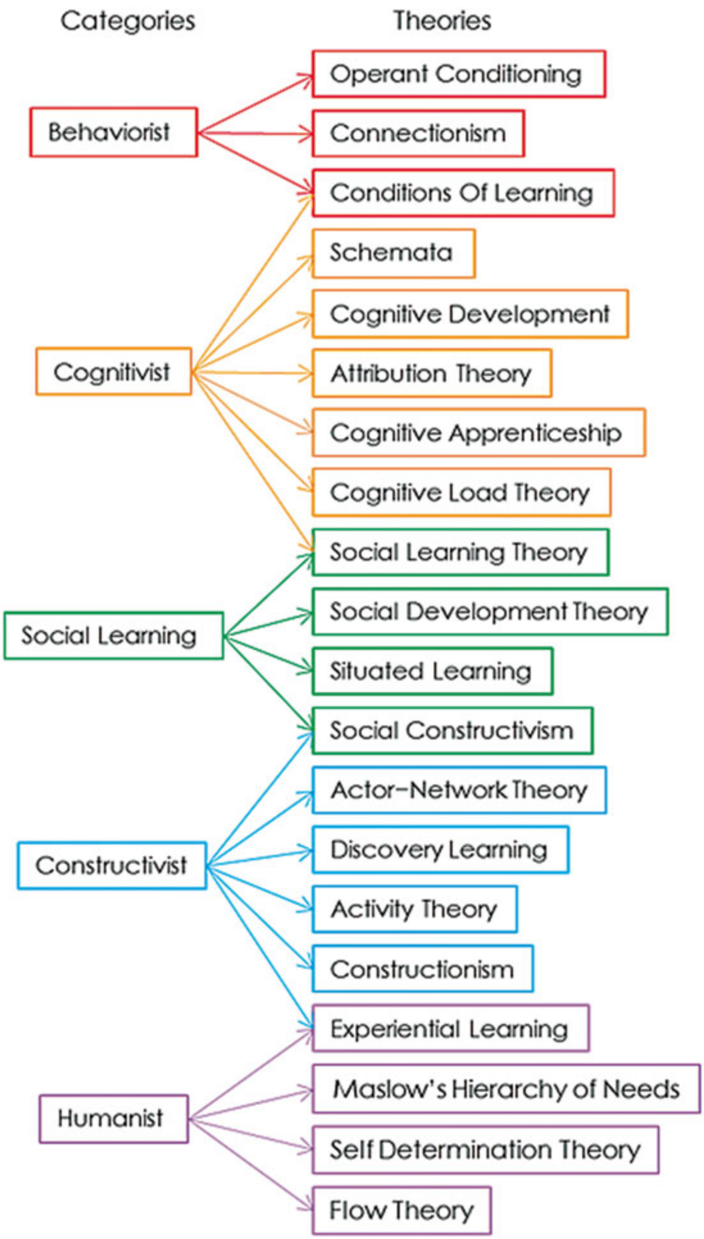


Fig. 2.4 Classification of learning principles, based on: Wu et al. (2012) and Merriam and Caffarella (1999)

2.1.1.1 Behaviorist Approaches

Popularized in the early decades of the twentieth century by Watson (Watson, 1925), Edward Thorndike, and B.F. Skinner, behaviorism grew out of animal studies and holds that behavior is the result of applied consequences, both positive and negative. In short, behaviorism follows these basic steps:

- Show stimulus
- Get response
- Reward or punish them, depending on how response compares to desired action

At one time it was thought that all learning could be thoroughly explained using only behaviorist theories; we now know that learning is much more complex than that. This does not, however make these theories invalid, simply inadequate on their own, especially in natural contexts (i.e., outside of a lab). In modern learning contexts, behaviorism is sometimes referred to as *direct instruction*, or *instructionism*, which, as the name implies occurs when the teacher instructs the learner directly. The approach is usually one of lecturing and demonstrating and is one where the learner is often seen as a passive (but hopefully willing) recipient of information.

While many of the classical behaviorist theories have fallen out of favor, some of the principles remain useful, and can still be used to effect in learning. Likewise, some aspects of behaviorist theories are used in the design of games, both educational and otherwise, and that's not always a bad thing. This is particularly true of *twitch games*, which involve fast responses such as making your character jump, punch, or shoot. For example, a p[layer may see an obstacle approaching such as a turn or banana peel on the road during a race (the stimulus). They must react quickly enough (the response), and, depending on how they do, they may crash (punishment) or earn points (reward).

Operant Conditioning

Classical conditioning as exemplified by Pavlov's dog is among the best known behaviorist theories, as is Skinner's theory of *operant conditioning* through either positive or negative reinforcement (Skinner, 1938). In classical conditioning two different stimuli are presented, one that will elicit a desired response (SC) and another that doesn't (SU). If this sequence is repeated often enough, the second stimulus (SU) becomes associated with the response and ultimately can elicit the desired response without the first stimulus (SC). The concept of operant conditioning followed after and posits that we can control behavior by reinforcing the things we want people to do and punishing the things we want them to stop doing. Teaching an animal to press a lever for food, or to avoid a particular item by shocking them whenever they touch it are both examples of operant conditioning.

While there are almost certainly aspects of at least some games that embody both of these theories, they are not especially favored in modern education, and there are few designers who would admit to using these theories as the basis for their designs, although there are exceptions. In his book "Playful Design," John Ferrera argues that basic rewards and punishments as well as deliberate schedules of reinforcement in games all stem from Skinner's fundamental theory (Ferrara, 2012). The idea of earning points for certain actions and losing points (or lives) for others in games are classic examples (Siang & Radha Krishna, 2003). In and of themselves though, these sorts of strategies do not hold the attention of players for long as the motivation is almost entirely external. Because of that it is questionable whether these should play a major role in educational game design, at least not any more so than the role they play in education generally, where learners earn grades for the things they do well and lose grades for the things they don't do well. Unfortunately, many educational games still rely on the principles of these theories far too heavily.

Connectionism

Edward Thorndike first described this theory at the beginning of the twentieth century. It grew out of the stimulus-reinforcement (S-R) framework of operant conditioning. Skinner's theory says that learning is the result of a simple cycle where the stimulus is presented, the subject responds and then is either rewarded if it is a behavior we want or punished if it is one we don't. Actions are strengthened by reward and weakened by punishment. Connectionism still holds that learning requires both practice and rewards, but it adds to that the notion that S-R connections can be chained together and that transfer of learning will occur in subsequent actions because of the previous associations. It was thought that the greater the number of connections one had, the greater their intelligence (Thorndike, 1910). This theory was defined by three laws:

1. Readiness: the S-R connections can be strung together provided they are connected as part of the same action sequence.
2. Exercise: learning requires practice.
3. Effect: learning requires rewards.

Each of these laws is embodied in most good games, whether they are learning games or not (Murphy, 2011). Just like the cat in the connectionism experiment first learned to escape from the box accidentally by pressing a lever, and then remembered because of the reward, there are many actions in games that people can stumble upon by exploring, clicking, banging, and so on. Once it has been discovered that a certain action will open some doors, or provide some other reward, that association is remembered and becomes part of the player's repertoire. In some cases the response is in the form of punishment—the avatar dies, or loses something. In that case it becomes something the player learns not to do.

Conditions of Learning

This theory is closely connected to an instructional design model (Gagné's Nine Events see Fig. 3.4 in the next chapter) which were both developed by Robert Gagné. Gagné's conditions of learning posit that there exist different types of learning that are distinguished from each other by the kinds of conditions needed to bring them about. Building on the foundations laid by Bloom's taxonomy (Bloom, 1956), Gagné connects the behaviorist approaches with early cognitivist approaches by naming eight different types of learning in order from simple to complex (Gagné, 1965):

1. Signal Learning—learning to respond to a signal—classical conditioning
2. S-R Learning—operant conditioning
3. Chaining—connectionism
4. Verbal Association—memorization
5. Multiple Discrimination—using sets of chains
6. Concept Learning—learning concepts
7. Principle Learning—learning principles
8. Problem Solving

Each one is said to require different conditions in order for learning to occur, and while the conditions of learning may not be used as the single underlying theory in many games (Wu et al., 2012), Gagné's ideas have gone on to inspire many instructional approaches that can be detected in many games. For example, some of the courses in *The New Super Mario Bros*. are quite challenging, and many people learn to get through them successfully by learning sets of actions (multiple discrimination) through many repetitions. Each time they fail, they can go back and try again having learned a little more of the course, and so hope to get a little farther until eventually they make it all the way.

The instructional design theory (the nine events) that came out of Gagné's early work on the conditions of learning (Gagné, 1985) has become a popular ID model and can be seen to be embodied in numerous good games explained in the next chapter (Becker, 2008).

2.1.1.2 Cognitive Approaches

Cognitivism came about as an attempt to delve beyond the largely instinctive or mechanistic theories proposed by behaviorism. Rather than being content with externally observed stimuli and responses, cognitive approaches attempted to understand the mental processes that are involved in learning. Put simply, these approaches are intended to make the learners think about what they are learning, and to provide them with patterns or frameworks for understanding. These frameworks can then be remembered rather than having to memorize lists of specific events.

Schemata

Piaget may have coined the term schemata, but it was Frederick Bartlett who introduced it to education in 1932. The concept has been further developed and expanded upon by various others, though the basic concept remains. A schema is a mental framework (or model) for understanding and remembering information. We remember things more readily if we can connect them to existing knowledge, and we tend to have more misconceptions when the things we are learning can't be connected to what we already know. In fact there is a strong tendency to attach new things to existing knowledge, even if it is done erroneously (Bartlett & Bartlett, 1995). In essence schemata are the result of the pattern building and pattern matching processes that underlies most of human learning. The concept of *scaffolding* as described by Wood, Bruner, and Ross (Wood, Bruner, & Ross, 1976) also relies on the idea that we remember information by building schemata.

Concepts of schemata are quite important in games. Schemata are used in games both by the players as they familiarize themselves with a new genre, game or game interaction (Lindley & Sennersten, 2008), but also by game designers as they design and develop the rule sets or game *artificial intelligence* (*A.I.*). The game's artificial intelligence is the set of data and algorithms that embodies the game's rules (da Silva & Vasconcelos, 2006).

Cognitive Development

Piaget's theory of cognitive development was a radical departure from the popular thinking of the day. Through direct observations of his own children, he theorized that cognitive development follows clearly defined phases determined largely be age (Piaget, 1951). While the specific age-relatedness of each of the phases has been largely shown to be false, the stages remain useful concepts, and many of our notions about the age-appropriateness of teaching certain concepts remain tied to them. These "phases" play a role in the kinds of games that are considered appropriate for certain ages, as well as in the designs of many educational games created for specific grades or age groups (Rosas et al., 2003).

Although Piaget's stages of development are perhaps the best known aspects of his theory, there were also two other components that have relevance for learning in general but also for game-based learning in particular. One is his notion of *schemas* (or schemata) as described in the previous section. Piaget thought of schemas as the basic building blocks of intelligence. In essence, these are the patterns of objects and actions that we know and recognize.

The other aspect of Piaget's theory that is germane to game-based learning is his adaptation model. Humans are extremely good at pattern matching and much of our learning is thought to be connected with classifying new objects and experiences into schemata that we already know. The process of this classification is not always immediate though, and Piaget theorized that when we encounter something that does not readily fit into an existing schema, we go through a process of adaptation (see Fig. 2.5). First we try to assimilate the new thing into our existing schema, but if that fails, we enter a state of disequilibrium, which drives us to find a way to accommodate the new thing and thereby achieve equilibrium once again.

Many games often make use of this theory (Hirumi, Appelman, Rieber, & Eck, 2010), such as when they present situations or challenges that are somewhat similar to those previously encountered, but that also incorporate other things that are novel. This is a very common approach in the kinds of actions needed to progress

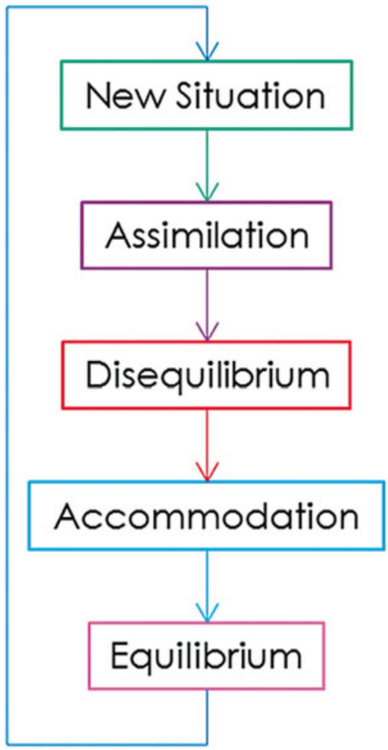


Fig. 2.5 Piaget's adaptation model

from one level to the next. However, many compelling games also present entirely new situations from time to time, thereby creating disequilibrium until the new situation has been accommodated.

Attribution Theory

Attribution theory is concerned with how individuals interpret events and how this relates to their thinking and behavior (Weiner, 1974). The theory suggests that people will try to understand *why* people do what they do. In other words they will try to attribute various causes to their behavior. This theory has become a major paradigm in research for social psychologists. Causes of events and behavior can be attributed to external causes such as luck, or to internal causes such as intelligence or talent (see Fig. 2.6), and the approaches one takes to learning differ depending on whether one attributes success and failures to internal or external causes. Attribution can also be seen as local (this event) or global (all events), and this too plays a role in whether people are more likely to keep trying or to give up.

Attribution theory plays into whether or not people persevere in a game and how they attribute successes and failures. Even in games that are largely ruled by chance, people who persevere in these games tend to attribute any successes they have to

Fig. 2.6 Thorndike's attribution theory

their own skill (Juul, 2013). Some studies have shown that attribution theory can also be used to explain some forms of toxic behavior in online games (Blackburn & Kwak, 2014).

While competition between classmates is seen by some as counterproductive (Kohn, 1992), one study found that allowing competition by surrogates (i.e., a pet that players control in the game rather than an avatar that effectively represents the player herself) actually increased motivation, and attribution theory could be used to explain why (Chen & Chen, 2013). It is worth noting that current research suggests that gender also plays a role in how people attribute cause to their actions and the outcomes (Butler, 2014). Males are more likely to attribute failure to external causes and success to internal causes, while females are more likely to do the opposite, and this in turn impacts perseverance.

Cognitive Apprenticeship

What sets this theory apart from other apprenticeship theories is its application of an apprenticeship model to the problem solving process. First described by Collins, Brown, and Newman (Collins, Brown, & Newman, 1987), cognitive apprenticeship sought to emulate the coaching and modeling strategies of traditional apprenticeship training with the use of technology in a way that would make thinking visible to both the teacher and the learner.

This explicit technological connection potentially makes it a natural fit with games, and indeed the basic tenets of this theory can be enacted in many games. These basic tenets are: content, situated learning, modeling and explaining, coaching, articulation and reflection, exploration, and sequencing (William deHaan, 2005). Interaction is essential to games so they are well suited to situated learning and modeling. Coaching and explaining are common aspects of the tutorial modes in games, and many games explain or demonstrate options and actions the first time the player access them. And while exploration is very often encouraged, most games are carefully sequenced through the use of levels and unlocking of spaces, actions, and items. The one area where games are often lacking, namely reflection, is very often compensated for by the players themselves when they create online social spaces where players can discuss the game. This external reflection component is an important one to remember in later chapters as we develop learning interventions that use games.

Cognitive Load Theory

Cognitive load theory is based on the notion that we have a limited capacity for attention in our working memory, and that learning can be facilitated when we support the learner by providing various aids that can reduce the demands on that memory (Sweller, 1988). There are three main categories of cognitive load:

1. Extraneous: imposed by the manner in which the information is presented
2. Intrinsic: comes from the learning task
3. Germane: devoted to processing the information and creating *schemas*.

Examples of reducing cognitive load to enhance learning include providing audio with text, organizing learning into small chunks, and reducing outside distractions. If we grant that we have a finite capacity for attention, then it would follow that anything we can do to reduce the attentional demands of the first two categories should increase our capacity to pay attention to the third.

Many games fully support this notion by reducing cognitive load in a multitude of ways (Corredor, Gaydos, & Squire, 2014). For example information is often presented in small chunks and the player can choose when to advance to the next screen. Integrated sources of information in games provide many different support mechanisms to help players remember things, thereby reducing the cognitive load, and freeing the player to concentrate on what they want (i.e., achieving the goal). Reducing redundancy is easily possible in games but it is best placed under user control so that the amount and frequency of repetition can be set by the user.

2.1.1.3 Social Learning Approaches

The primary component to social learning theories is the influence of other people, so it is a somewhat more outward looking perspective than the humanist view which is more inward focused. Social learning approaches use the power of cooperative and collaborative networks so learners can guide, support, and teach each other.

Social Learning Theory

Social learning theory was proposed in the late 1970s by Albert Bandura and focuses on the kind of learning we do by observing others, both in person and indirectly, through television, books, film, games, and others media (Bandura, 1977).

The idea of learning that is accomplished through observation or modeling has its roots in behavioristic theories, but Bandura's theory actually straddles the cognitivist and social categories as it touches on cognitive processes as well as well as including the social aspect.

Showing how something is done through demonstration is a common approach in the tutorial modes of many games, but ideally once the demonstration is complete, the player will be given an opportunity to try the action for herself. Unfortunately, much of the recent research into connections between social learning theory and games focuses on media effects and violence in video games (Hartmann, Krakowiak, & Tsay-Vogel, 2014) which is a complex field and beyond the scope of this book. However, if we accept Bandura's theory, then it should be possible to model both bad and good behavior in games and to have people learn from them.

Social Development Theory

Although Vygotsky's work took place at about the same time as Pavlov's, his ideas did not become widely known until long after he died when translations of his works were published in English. Vygotsky is best known for his proposition that cognitive development requires a social context in order to reach its potential. Through his theories about the "zone of proximal development" (see Fig. 2.7), he suggested that an individual could achieve far more with some help than she could alone. Further, the level of achievement possible with help (ZPD) varies from one individual to the next, and can be used as a measure of potential. "Experience has shown that the child with the larger zone of proximal development will do better in school. This measure gives a more helpful clue than mental age does to the dynamics of intellectual progress" (Vygotsky, 1934).

Given Vygotsky's emphasis on social interaction, he is one of the earliest and strongest champions of collaborative work, and in some ways it is not surprising that the idea still has not really caught on in North American school systems, except to an extent at the elementary level. The school system here remains largely an adversarial, competitive environment. This is easily evidenced by the continued reliance on homework where collaboration is typically not encouraged, and the tenacious adherence to "individual work" and isolation during exams. While some of this has to do with cost-effectiveness and efficiency (out of school collaboration is likely to require technological support, and isolation is easier to invigilate during tests), some suspect much of this is due to the fundamentally competitive and adversarial nature of our educational system and its administrators (Kohn, 1992).

By contrast, game-based learning is often quite collaborative; sometimes making use of peers; sometimes mentors, and sometimes a proxy in the form of the game AI. In this way the game environment actively supports Vygotsky's "zone." In fact, many games would be unplayable at one extreme, and unchallenging at the other if they did not rely heavily on a modern equivalent of Vygostky's zone (Sun, Wang, & Chan, 2011).

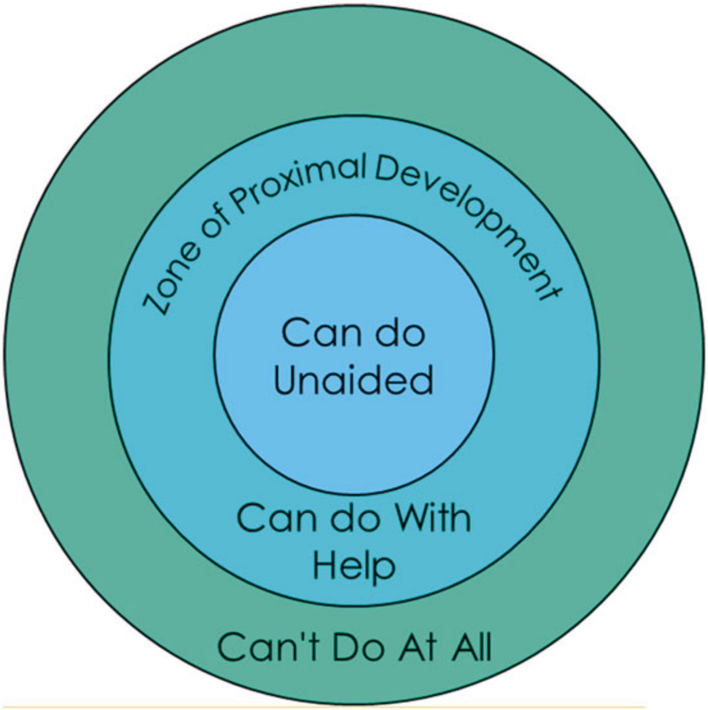


Fig. 2.7 Zone of proximal development

Social Constructivism

As the name implies, *social constructivism* applies the theory of constructivism in a social context (Vygotsky & Cole, 1977). In other words, this is a theory of how meaning is constructed through shared ideas and experiences. One of the great pragmatists, John Dewey concerned himself with that which was immediately applicable. His ideas seemed to be right for the time, because they dramatically changed the face of educational thought in North America, relegating "classical education" to a position worthy of scorn (Dewey, 1963). Dewey called for education to be grounded in real experience, and that included collaborative work.

The idea that we construct meaning through collaboration and shared ideas and experiences seems like such a natural fit with games that it hardly needs explanation. While this has obvious applications in multiplayer games, if we include the various social networks associated with various popular games, it also plays a role in single player games. In the classroom we can of course create a social space with any game whenever we support or encourage classroom reflection, discussion, or sharing of experiences (Galarneau, 2005).

Situated Learning

Jean Lave is generally credited with first describing this theory and it is a significant concept. According to Lave, learning is a function of activity, context, and culture—it is situated (Lave & Wenger, 1991). Unfortunately, judging by the experiences of all three of my own children in a total of eight different schools, classroom situations are not often like this. Jean Lave states that social interaction is a critical component of situated learning—participants build a “community of practice.” Newcomers or beginners start off at the periphery but eventually become encultured and can ultimately assume the role of expert through “legitimate peripheral participation.” The concept of situated learning has proven to be a fertile beginning for numerous other concepts, including those of Brown’s cognitive apprenticeship (Brown, Collins, & Duguid, 1989) and Clancey’s situated cognition (Clancey, 1995).

The potential for simulations in general and games in particular to create just the kind of environment Lave describes exists now—what’s lacking is a broad recognition of this fact. Perhaps the connection is too obvious to warrant explicit description. In his book on video games and learning, Kurt Squire devotes an entire chapter to the connection between situated learning and games (Squire, 2011). In it he talks about how students playing *Mad City Mystery*, which is an environmental augmented reality game where each player plays a different role with different skills. “(I)t immerses each player in a role with unique abilities, which we hope increases role identification. Second, differentiated roles require players to synthesize what they read. Third, it creates responsibility, as players are accountable to their group for understanding their information. Finally, it creates a cooperative, distributed puzzle-solving game, which provides a pleasurable context for meaningful interactions with content” (Squire, 2011, p. 184).

In many ways, John Sealy Brown’s notion of cognitive apprenticeship has picked up where Jean Lave left off—but his perspective is decidedly digital. He is interested in the “social practices and constructivist ecologies being created around open source and massively multiplayer games” (Brown, 1999).

2.1.1.4 Constructivist Approaches

Constructivist approaches have their roots in the traditional apprenticeship model for learning. Of prime importance here is that active engagement in authentic activity takes place as part of the learning process. The original driving force behind the development of constructivist approaches was Jerome Bruner who saw learners as building on existing knowledge by adding and incorporating new knowledge (Bruner, 1960). Constructivist learning requires conscious and active meaning making on the part of the learner.

Actor–Network Theory

No-one acts alone; we are all part of a network. This is the core concept of the actor–network theory (ANT), which was originally developed as an approach to social theory and research (Latour, 1996). However, ANT is not describing a typical social network; it includes nonhuman objects as part of a network that both influence and interact with the individual (Law & Hassard, 1999). Rather than on the one hand, assuming that technological outcomes can be attributed solely to the technologies, or on the other hand, that technology can be wholly explained by social relationships and theories, ANT proposes that it is really the interaction between humans and technology that is needed to explain outcomes.

Given that perspective, this theory also seems to imply a natural fit with games. It has been used to effect in analyzing difficulties learners sometimes have with various aspects of the user interface in games and some challenges they encounter in understanding in-game tasks (Law & Sun, 2012). It has also been applied to such things as examining the ways in which online game play can be dependent on real-life contexts (Cypher & Richardson, 2006) (Taylor, Jenson, de Castell, & Dilouya, 2014).

Discovery Learning

There are now many different approaches to the basic idea behind discovery learning, which at its core is the idea that we learn by creating hypotheses about how things are and then experimenting to test that hypothesis. It is fundamental to most research in science, and is at the core of inquiry-based approaches to learning. Jerome Bruner is often credited with originating discovery learning (Bruner, 1961), but it was influenced by many, such as John Dewey (Dewey, 1916), Maria Montessori (Montessori, 1964), and even William James (James, 1915).

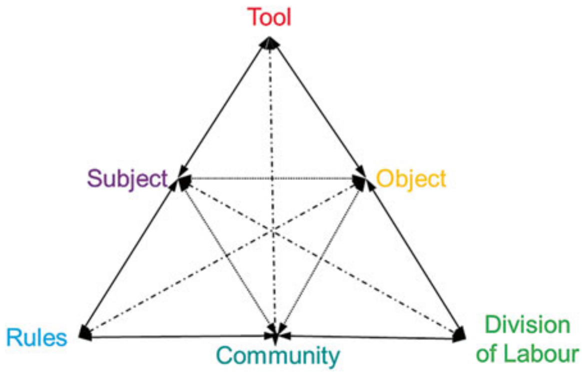
Discovery learning is sometimes mistaken to imply that learners should be allowed to follow their whims and learn through pure self-discovery, but that isn't really what Bruner had intended (Mayer, 2004). Given that games always restrict and direct the players actions and attentions, they can provide an ideal medium for the enactment of discovery learning approaches (Hannafin, Hill, Land, & Lee, 2014). It has been claimed that one of the great advantages of games for learning is precisely because they support learning through trial and error combined with feedback (Gee, 2009).

Activity Theory

Activity theory is not new and though its roots are elusive many have contributed to this line of thought, including Lev Vygotsky (Vygotsky & Cole, 1977), A.N. Leont'ev (Leont'ev, 1978), and A.R. Luria (Luriĕiìa, 1976) in Russia. The main focus of this theory revolves around the interrelationship of the subject (the learner), the object (the goal which leads to the outcome), and the tools (both physical and conceptual) used to mediate between them. It suggests that the relationship between objects in the environment and people are mediated by culture and its rules, the community, and by labor and its roles and development (See Fig. 2.8). As this model is both object-oriented and artifact-mediated it is an obvious fit for games.

There have been a number of researchers who have applied Activity Theory to game-based learning. Oliver and Pelletier (Oliver & Pelletier, 2004) designed a

Fig. 2.8 Activity theory



framework using activity theory's concept of contradictions that would enable them to track the process of learning without disturbing the natural flow of game play. Kuutii defined contradictions as "indicating an unfit within elements, between them, between different activities or different development phases of a same activity"[1](Kuutti, 1996, p. 34). They had proposed designing contradictions into the game deliberately in order to provide learning opportunities. Activity Theory is descriptive rather than predictive, and as such offers a useful perspective through which to view the design of games as well as how people learn with games (Hadziomerovic & Biddle, 2006).

Constructionism

Sometimes confused with constructivism, constructionism is the idea of learning through building or making things, and games have figured prominently in this approach since it was first described by Seymour Papert in the 1980s (Papert, 1980). The basic idea behind constructionism is that people can learn about something by building an artifact that uses or teaches that thing.

Constructionism is in a sense an outlier in the collection of learning theories connected with games, as rather than learning through playing games, this approach advocates learning through building games. So for example, one might learn about flight by building a game where the players must fly an aircraft it in order to achieve the game goals. Building games can help such things as supporting creative collaboration (Kafai, Fields, Roque, Burke, & Monroy-HernÁNdez, 2012) and informal knowledge building (Baytak & Land, 2011).

[1] In the process of tracking down the original source of the Kuutii quote, it was discovered that the majority of places using it had misquoted it by using the word "misfit" rather than "unfit." Interestingly, a variety of sources were cited, and a good number of publications used the exact definition without marking it as a quote.

2.1.1.5 Humanist Approaches

Humanism uses the perspective of human potential for growth. It rejects the notion that behavior is predetermined (as behaviorists do) or that it is determined primarily by environment or the subconscious. It assumes that people are inherently good and will strive to better themselves and their environment. What we need to do is provide them with opportunities to better themselves.

Experiential Learning

Many of the constructivist theories talk about the importance of practice, but Kolb's experiential learning theory is a humanist theory in that it focuses on the transformation of the experience as the agent of knowledge construction. Each stage involves deliberate thought and together they form a connected circle (See Fig. 2.9). Unlike many other theories, Kolb's theory allows for any stage to be the initial one, but the progression from one to the next follows in the same order regardless of entry point (Kolb, 1984).

Ideally, learners will possess balanced abilities in each of the four areas, but in reality, they tend to polarize towards one of four "poles" (Kolb & Fry, 1975). These four poles are identified as different learning styles as summarized in Table 2.1.

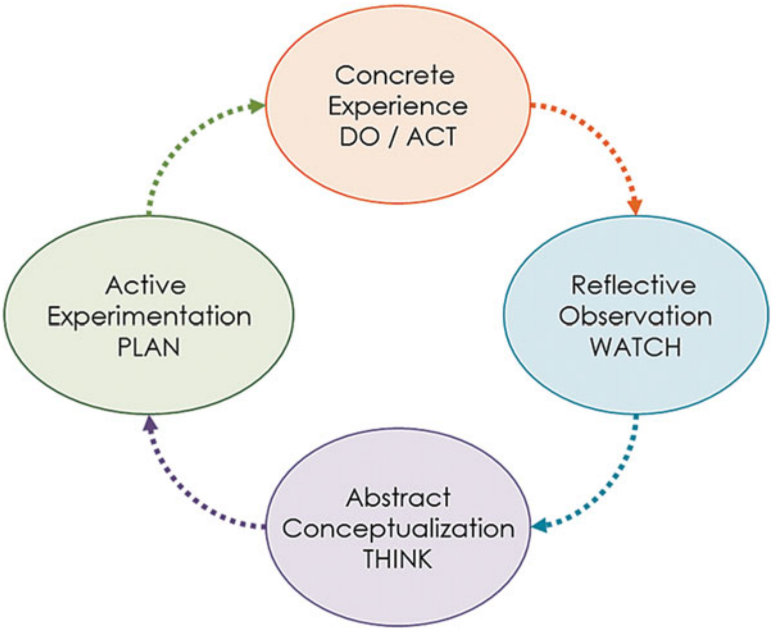


Fig. 2.9 Experiential learning

Table 2.1 Kolb's learning styles

Learning style and characteristic	Description
Converger: Abstract conceptualization (AC) + active experimentation (AE)	• Practical application of ideas • Focus on hypo-deductive reasoning on specific problems • Unemotional • Narrow interests
Diverger: Concrete experience (CX) + reflective observation (RO)	• Imaginative ability • Generates ideas and sees things from different perspectives • Interested in people • Broad cultural interests
Assimilator: Abstract conceptualization (AC) + reflective observation (RO)	• Can create theoretical models • Excels in inductive reasoning • Abstract concepts rather than people.
Accommodator: Concrete experience (CX) + active experimentation (AE)	• Doing • Risk taker • Can react to immediate circumstances • Solves problems intuitively

A key aspect of good games is that the player can take up the game in many different ways: as a neutral orchestrator, or as an impassioned participant. Games encourage accommodator abilities of immediate reaction to circumstances and converger abilities of the application of ideas, both within the bounds of the "magic circle" of play because the usual rules and consequences of reality don't apply. Divergers can identify with other players or *NPCs* (*non-playable characters*) as though they are people, and assimilators can relate to them using whatever conceptual frameworks they like. Some will lead to greater success within the game than others, but the fact remains, that it is only a game—exploration and experimentation are actively supported in most good games (Becker, 2007).

Maslow's Hierarchy of Needs

Although this theory is more commonly viewed as a theory of motivation, it has become a popular theory in professional training (Teach & Murff, 2014), learning in practice in nursing (Inch, 2013), as well as for examining such issues as perseverance and retention in higher education (Kim & Irwin, 2013). Maslow theorized that we all have similar needs that can be classified into five broad categories, usually represented as a hierarchy (See Fig. 2.10) and that the needs at the base of the pyramid must normally be met before those at the higher levels can be attended to (Maslow, 1943).

In relation to games, Maslow's theory is used to explore and understand how peoples' needs as reflected by their interactions inside a game as well as their needs in

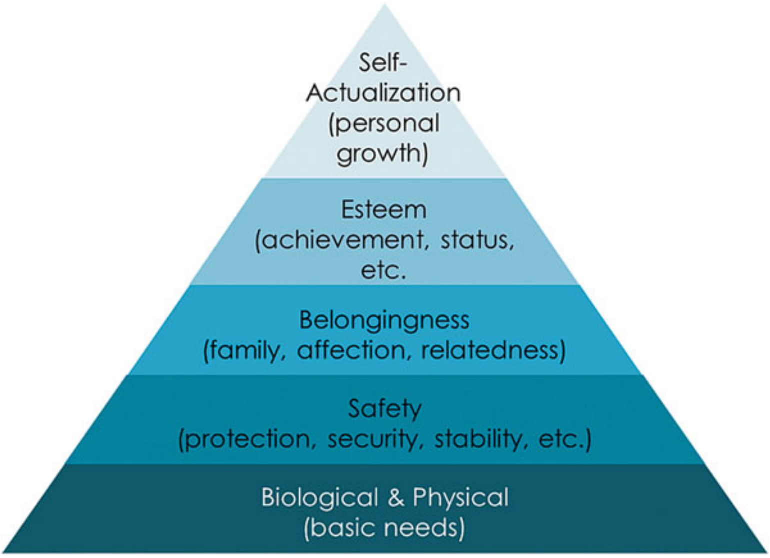


Fig. 2.10 Maslow's hierarchy of needs

real life can impact learning. It has been used to explain a lack of success in business simulations due to unmet basic needs (Teach & Murff, 2014), and how different backgrounds and major subjects of study can affect the ways in which learners' personal values, game attributes and learning effects interact (Lin & Lin, 2014).

Self-Determination Theory

Self-Determination Theory (SDT) was first described by Edward Deci and Richard Ryan in the late 1970s (Ryan & Deci, 2000) and has gained broad acceptance. SDT (see Fig. 2.11) posits that there are three drives that are fundamental to human motivation. These are: competence, autonomy, and relatedness, and these elements are innate psychological needs that drive everyone. People are motivated by any endeavor that satisfies these basic needs. Now that's not to say that every person reacts the same way, or even that every endeavor will fulfill these needs in the same way for each person, but it *does* mean that something has to address these needs sufficiently before an individual will find it motivating. Let's look at each of the requirements in turn and see how they relate to G4L.

Competence—Put simply, competence means to be demonstrably, recognizably good at something. We have all experienced how being able to improvement often spurs us on to try harder. With the same token, improvement that comes too easily can have exactly the opposite effect. That means there is a "Goldilocks Effect"—an ideal degree of effort coupled with an ideal rate of improvement. Associated with that is also a certain amount of frustration, but here too the amount of frustration

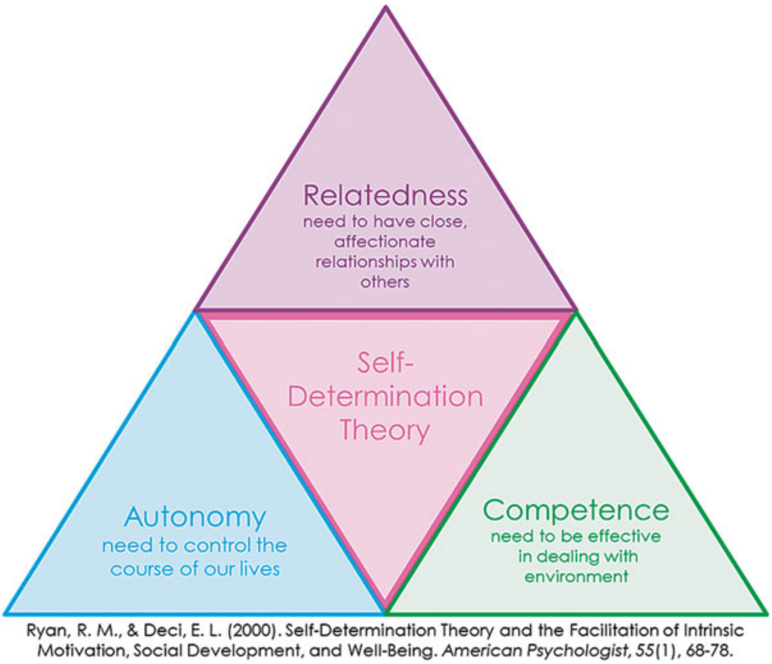


Fig. 2.11 Self-determination theory

that we are willing to accept is an individual thing so one size does not fit all. A game that is lacking balance by being too easy or too challenging is not likely to be enjoyable and thus also not like to motivate people to complete it.

Autonomy—Autonomy is about independence and the freedom to choose for oneself. An obvious example is that of a child learning to tie her shoes or write her own name, and the obvious joy she gets from finally doing it by all herself. A game that provides too much help or one that does not allow for sufficient choice is unlikely to meet anyone's need for autonomy, and will not be seen as fun or motivating.

Relatedness—Relatedness refers to the feeling of being connected to others and of both caring for and of being cared for. While not all games are social games, the element of attachment and some form of tending (of either animate or inanimate objects) is common to many successful games.

Learning that is intrinsically motivated is generally considered to be more desirable than that driven extrinsically. Motivation has been shown to predict academic behavior and is a reliable predictor of success or failure (Legault, Green-Demers, & Pelletier, 2006). We also know that of the three elements, perceived competence plays a smaller role in predicting the level of intrinsic motivation than the other two (Waterman et al., 2003). Self-determination theory also explains some of the popularity of games, and it is important to consider this when choosing and using games in the classroom.

Flow

The main idea behind Csikszentmihalyi's *Flow Theory* is that of an optimal experience (Csikszentmihalyi, 1991). Csikszentmihalyi was interested in understanding what made people spend their lives doing things for which they did not expect fame or fortune, but which nonetheless made them happy. During his early research, Csikszentmihalyi realized that people have a finite capacity for attention, in other words we can only pay attention to so much at any given time. When we encounter something that we really enjoy, we devote more attention to that, thereby leaving less attention available for other things. This is why we sometimes fail to notice other things happening around us when we are deeply engrossed in a book, game or other activity. We often fail to notice the passage of time, and may not notice other people around us, or even that we are hungry, or that it has started to rain and we are now wet.

Initially, it was believed that this state of flow could only be experienced by those who had been trained as professionals in a particular field—experts—and who had spent considerable time practicing. There is even a theory that suggests expertise requires a particular amount of practice. In his 2008 bestseller "Outliers," Malcolm Gladwell claims that it takes 10,000 h of practice to become an expert (Gladwell, 2008). While this claim has since been refuted (Hambrick et al., 2014), it remains a popular notion. The concept of flow on the other hand continues to be studied and has become widely accepted. It has been determined that it is not only the experts but rather anyone can experience this state of flow when they become completely immersed in some sort of activity or experience and that gives it broad applicability.

There are seven criteria that characterize the state of flow. These seven criteria seem to apply regardless of the nature of the activity or the culture in which it is observed, and that brings us to its relevance to games. A state of flow is said to exist when the following criteria have been met:

- Complete involvement in the activity.
- A sense of ecstasy—in other words, of being outside of everyday reality.
- A feeling of great inner clarity—knowing exactly what to do and that we are capable of doing it.
- Knowledge that the activity is doable.
- A sense of serenity—freedom from worry or stress.
- Timelessness—no longer paying attention to or noticing the passage of time.
- Intrinsic motivation—the activity becomes its own reward.

Given the popularity of games as entertainment, it should come as no surprise that videogame players have at times described experiences that characterize flow while playing games, and it is something many gamers strive for. In recent years, Flow has become like the holy grail of game design. However, just like any other complex design discipline, no one thing is likely ever to guarantee success. Further, while the state of flow has been identified across cultures, the activities that prompt this state vary greatly, and therein lies the challenge. Commercial entertainment games typically target a specific demographic audience (18–35-year-old males, for example), and the genre of the game, whether it is a first person shooter, *adventure game* or what have you, will further narrow the likely audience. When we design and use games in formal learning, the age-range is often quite narrow, but the audience is rarely voluntary. In other words they will be told to play the game, rather than choosing to do so of their own volition. Even if the setting (i.e., course) is optional, a game, when it is used in such a setting is usually part of the curriculum, and so is typically not optional. Striving for a design that induces a state of flow in its players, while, desirable, is often unrealistic. Flow remains a useful concept, and numerous researchers have used it successfully to measure player engagement and enjoyment (Sweetser & Wyeth, 2005) (Nacke & Lindley, 2008) (Liu, Cheng, & Huang, 2011).

While there are certainly more theories that relate to games, these 20 represent a broad sample and provide us with rich theoretical foundation. Learning theories should form the framework that underpins the design of games for learning, but in their meta-analysis of 658 game-based learning studies, 567 of them failed to describe even one learning theory relevant to the study (Wu et al., 2012). Nonetheless, keeping an eye on these theories as we look at ways to choose and use games in the classroom will help us to better assess games for their suitability in educational contexts.

2.2 The Clark–Kozma Debate, Revisited

> In a culture like ours, long accustomed to splitting and dividing all things as a means of control, it is sometimes a bit of a shock to be reminded that, in operational and practical fact, the medium is the message. This is merely to say that the personal and social consequences of any medium - that is, of any extension of ourselves - result from the new scale that is introduced into our affairs by each extension of ourselves, or by any new technology. (McLuhan, 1964, p. 7)

We keep hearing that everything old is new again and like many other ideas, theories, and attitudes in education seem to go in cycles. The edutainment era of the 1980s and early 1990s coincided with an exchange of opposing viewpoints about the impact of technology on learning that has become known as the Clark–Kozma Debate, and now, in the midst of an educational games revival we also see a renewal of this decades-old debate. At its core it is about the impact that technology has on the instructional "message." Standing on one side of the debate is Richard E. Clark[2]. While there have been a number of opponents standing on the other side of this debate, the first one was Robert Kozma,[3] even though he didn't weigh in until several years after Clark's first "volley" (Kozma, 1991).

[2] Richard E. Clark, professor of Educational Psychology and Technology and the director of the Center for Cognitive Technology at the University of Southern California's Rossier School of Education.

[3] Robert Kozma, Independent Consultant and Emeritus Director, Center for Technology in Learning, SRI International.

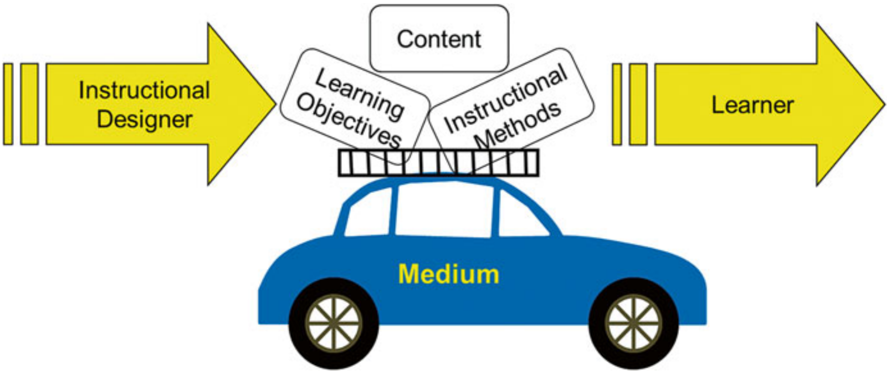


Fig. 2.12 The medium as the vehicle

R.E. Clark started the ball rolling when he published the results of a meta-analysis that examined the influence of media on learning where he concluded that media do not influence learning under any circumstances (Clark, 1983). This is quite a strong position and it is one that Clark has stood by for 30 years, in spite of whatever media developments have occurred in the meantime. The medium is not the message according to Clark, but rather it is merely the vehicle whereby instruction is delivered and has no influence on instruction, just like the truck used to deliver goods to a store has no influence on the groceries it carries (see Fig. 2.12). He expands the analogy by explaining that the only factors affecting the choice of "vehicle" are practical ones, such as cost and distribution, and that the only influence on learning comes from the instructional method. Any benefit that comes from the use of media is passed off as essentially wishful thinking. In 1983, Clark recommended that researchers give up on exploring the relationship between media and learning unless new theories are suggested (Clark, 1983).

The response that triggered the "classic debate" did not appear until 1991, when Richard Kozma met Clark's challenge and proposed a new theory outlining the synergy between media, content, and the interaction of the learner with that environment (Kozma, 1991). Kozma reviewed the literature on the use of various media forms, including the use of books and television, and concluded that various media have distinct symbol systems and processing capabilities that can complement those of the learner and produce a unique experience. In this way, he reasoned, the medium *does* have an impact.

In spite of various volleys back and forth by Clark, Kozma, and others there remains no conclusive evidence that any one medium is more effective than any other. Clark still uses this to conclude that specific media choices are irrelevant to educational outcomes, while Kozma remains optimistic that effects will become noticeable and suggests we consider the effects based on the attributes of the medium rather than the specific medium itself. It is noteworthy that Clark bases this conclusion on research conducted largely before the turn of this century because much has changed since then. The "technology" of Educational Technology is vastly different now and discussing the effectiveness of media, potential or otherwise in 2007 (Clark, 2007) as he did using reports from more than 10 years before is like discussing today's traffic issues using data from 1820.

Times have indeed changed, and what we can do with the technologies available for use in education and elsewhere are fundamentally different in many ways from the kinds of technologies on which Clark based his conclusion of its irrelevance. It may have been OK to dismiss computer technology at the start of the Edutainment Era in the early 1980s. After all, it could have been merely a passing fad. It is not as easy to dismiss it now, yet that is what Clark did in 2007, when he revived his debate by claiming that serious games suffer from the same shortcomings as other media and that the lack of irrefutable evidence of superiority justifies the dismissal of the medium as a primary mechanism of instruction (Clark, 2007).

That's where games come into the picture.

It is possible to view games as mere receptacles for content rather than as teaching methods as Clark would have us do, but we can only do that in a select subset of games such as puzzles and those that emulate a typical television game show format. Such games represent a very small portion of the ways in which games can be and have been used to facilitate learning, and in fact most educational games where the game component is obviously a receptacle for the content have been widely accepted as poor designs for some time (Jenkins, 2002). In Clark's second original article written in 1994, he argues that since no single media attribute forms a unique cognitive effect, the attributes are not important. Clark tells us that "Whenever you have found a medium or set of media attributes which you believe will cause learning for some learners on a given task, ask yourself if another (similar) set of attributes would lead to the same learning result" (Clark, 1994, p. 28). Humans are incredibly adaptable when it comes to learning, and when there is sufficient need or motivation most people are able to compensate for less than optimal learning conditions. This is comparable to saying that if people can learn from a bad teacher, there's no need for any good ones, which clearly isn't the case.

We all know it is possible to make do with nothing but lectures and textbooks, but we acknowledge the importance of creating a learning environment that actively engages the learner in the task at hand (Schank, Berman, & Macpherson, 1999) and whether we refer to videogames as media or simply "delivery methods" does not alter the fact that games and game technology offer a mechanism for "learning by doing" that in many cases would be too expensive or dangerous to do in real life (Aldrich, 2009). There are lessons that simply cannot be delivered at all without the use of modern technology. It is hard to imagine the space program succeeding without the help of the simulators they used for training. Imagine if NASA's primary choice for training were to sit their astronauts down at desks and lecture to them! In many cases, the medium **does** make a difference and it is to our advantage to understand it as thoroughly as possible. We will be able to make best use of our tools if we understand how they work and what their limitations are. Videogames are our tools.

2.3 All Games Teach

Remembering from the previous chapter that learning and education are not the same thing, it can be claimed that all games teach in that all games prompt learning. No matter what kind of game it is, the path to the end always requires the player to learn something: new facts, new skills, new strategies, and so on. This is true of all games, even puzzle games, at least the first time they are played. Players will sometimes go back and play through a game again and again even though they have already beaten it. Why? Well, because there is still more that they can learn. Chris Crawford who has been referred to as the father of political games says that "true fun is the emotional response to learning" (Leupold, 2004). According to Raph Koster, author of "A Theory of Fun for Game Design" enjoyment in games triggers the release of endorphins, which actually comes from learning. "One of the subtlest releases of chemicals is at that moment of triumph when we learn something or master a task. This almost always causes us to break out into a smile. After all, it is important to the survival of the species that we learn—therefore our bodies reward us for it with moments of pleasure. … Fun in games arises out of mastery. It arises out of comprehension. It is the act of solving puzzles that makes games fun. In other words with games, learning is the drug" (Koster, 2004, p. 40).

When asked why players continue to play a game after they have beaten it, they will often say they do this because there are still more things to discover—more things to explore, different endings, and so on. All of these involve learning. The player isn't well and truly done with a game until there is nothing more to be learned from it. Looked at from a different perspective, this implies that the more there is to learn in a game, the more replayability it has. However, at the other end of the spectrum, there are also some games that are what the author refers to as "Sorting & Organizing" games (such as *Tetris* and *Bejeweled*) where replayability does not rely on learning something new, but instead taps into our natural propensity to classify as a means of making sense of the world. Notwithstanding, even these include learning at the beginning, as well as the development of strategies throughout.

2.4 Why Games?

Why are games worth promoting and using in formal educational settings? Among the first scholars to promote modern videogames as being good for learning was Jim Gee in his book, "What Videogames have to Teach Us About Learning and Literacy" (Gee, 2003). His 36 principles have become well known for connecting notions of what is considered good practice in situated learning to what is experienced while playing (good) games. While some of these principles would appear to be idealized extrapolations of what commercial games have to offer, they do present a fairly comprehensive set. In a later work, Gee has reduced his 36 principles to a somewhat more manageable list of six game properties that explain how games are valuable as learning environments (Gee, 2009). These properties touch on:

- *affordances* facilitated by the rule system of the game
- the player's ability to exert control over the environment through customization and both direct and indirect interaction
- the experiential quality of many games
- the designed connection between what can be done in the game and the skills and abilities being developed in the player
- the creation of more or less concrete models to illustrate abstract concepts
- the ability of the player to enact his or her own story.

While all of these properties do exist in some games, none exist in all games (not even the "good" ones) so we must look further to uncover reasons for accepting games as valid educational technologies. Rather than simply pointing out what's good about good games, it might be more helpful to look at what kinds of things games can do well in the context of the kinds of things we typically want to teach in a formal setting.

What then do games do well? According to the report produced in 2006 by the Federation of American Scientists (Federation of American Scientists, 2006, p. 5) there are several attributes of games that would be useful for application in learning. These include:

1. contextual bridging (i.e., closing the gap between what is learned in theory and its use);
2. high time-on-task;
3. motivation and goal orientation, even after failure;
4. providing learners with cues, hints, and partial solutions to keep them progressing through learning;
5. personalization of learning; and
6. infinite patience.

The AFS came out in strong support of the use of games in formal learning when it said that "(s)chools of education and teacher professional development providers should create new training materials and make developing skills to support game-based learning an integral part of new and incumbent teacher training" and "(e)ach major educational institution should develop and execute a strategy for changing instruction to reflect the kinds of innovations in games and other areas expected in the coming decade. Schools should redesign their instructional practices and formal learning environments to take advantage of technology-enabled exploration, interactivity, and collaboration encouraged by digital games and simulations" (Federation of American Scientists, 2006, p. 10).

Are there properties of games that make them *better* suited for certain kinds of instruction than other methods? While numerous reviews of the literature have turned up promising indicators (Clark, Tanner-Smity, & Killingsworth, 2014; Felicia & Egenfeld-Nielsen, 2011; Stokes, Walden, Nasso, Mariutto, & Burak, 2015; Turkay, Hoffman, Kinzer, Chantes, & Vicari, 2014; Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013), it's not clear that we will ever come up with a definitive answer to that question. The FAS outlined a number of attributes of games that make them potentially useful for learning. For our purposes, let's narrow that to the context of formal educational settings.

As we progress through this book we uncover additional attributes of games that can be useful in formal contexts, but for now here is a partial list:

- Cost: Given adequate access to computers or mobile devices, games can be cost-effective.
- Risk: Games offer opportunities to play out roles that would not be possible in real life (because they are impractical, exclusive, expensive, dangerous, etc.). Players can be astronauts, or go back in time, or travel the world, without ever leaving the classroom.
- Exploration: Games offer opportunities to try out scenarios that would not be possible in real life. They allows to explore those "what if" questions—especially if transgressions are involved (e.g., What if we didn't take proper care of our teeth?)
- Time: In games, we can speed up and slow down processes to allow learners to experience continental drift, or a nuclear reaction.
- Scale: Similarly, we can interact with a system on a universal scale, or a microscopic one.
- Games allow for continual assessment. Everything a player does in a game can be tracked: the choices they make, the places they go, and how long they stay there. All of these things can be used to build a profile of the player that can then be used to see where they struggle and what they find easy.
- Rapid feedback. Since actions in a game can be monitored as part of the game itself, it becomes possible to provide immediate feedback when desired.
- Abstraction: can make abstract concepts concrete. It is possible in games to embody any concept, process, or relationship and to allow the player to interact with it.

Ultimately, learning in games often happens in ways comparable to how learning happens in situated, experiential contexts. The word "often" is used here because there are many kinds of games from very simple to very complex and different kinds of learning are likely to be facilitated by different kinds of games.

2.5 Why NOT Games?

If we accept that games can be valuable as teaching and learning tools, what then are some of the challenges involved with the use of games in the classroom? It is important to examine both sides of this issue. Even though a game may have all the qualities deemed important in a game, it may still be a poorly designed game and unsuccessful in meeting its objectives, just as a novel can possess all the right pieces in all the right proportions and still be a boring story.

Some of the reasons games are sometimes seen as undesirable are the same as reasons applied to other media: “We often assume that stories told in one medium are intrinsically inferior to those told in another. Shakespeare and Jane Austin were once considered to be working in less legitimate formats than those used by Aeschylus and Homer. One hundred years after its invention, film art still occupies a marginal place in academic circles. The very activity of watching television is routinely dismissed as inferior to the act of reading, regardless of content.” (Murray, 1998, p. 273)

Dismissal on the basis of novelty aside, there are some legitimate concerns that should be considered when thinking about using games in formal contexts. A recent study conducted by the Games and Learning Publishing Council looked at various aspects of the use of digital games in the classroom. One of the questions they examined was about the barriers facing teachers using games in their classrooms (see Fig. 2.13). This is largely in line with the results of a study we conducted in 2005 (Becker & Jacobsen, 2005). One noteworthy (and encouraging) difference is that in 2005 one of the most significant barriers to the use of games was a lack of administrative support, yet in the more recent study, lack of support had dropped to near the bottom of the list. In the 2014 study, the most significant barriers include lack of time to incorporate games (45 %), cost (44 %), lack of resources (35 %), and curricular connections (34 %). There are also concerns over the emphasis on standardized testing, but this can probably be lumped in with curricular concerns. After

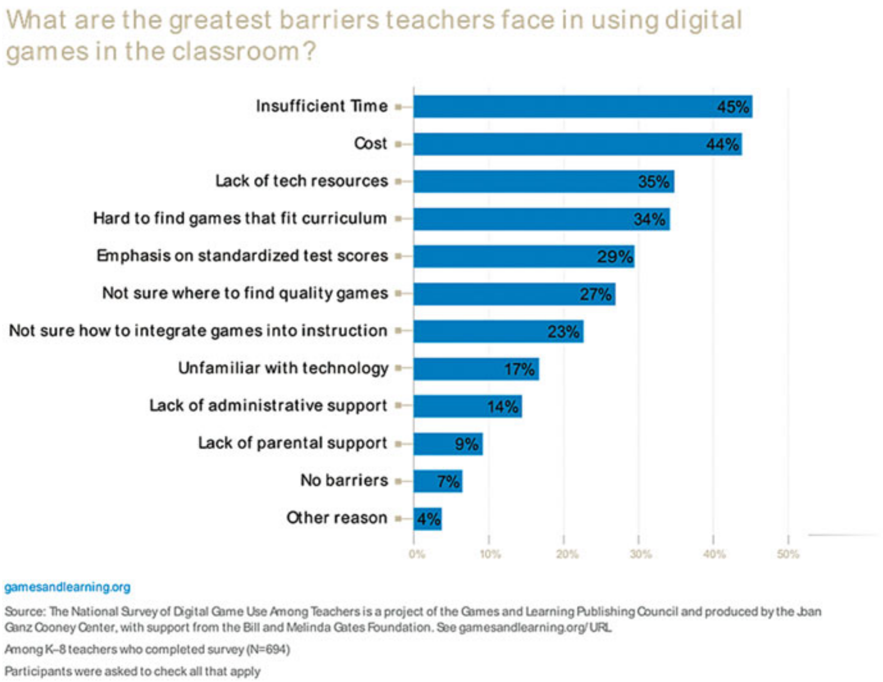


Fig. 2.13 Barriers to the use of games in the classroom (Takeuchi & Vaala, 2014)

that, there are also concerns about how to find and integrate games. The last two really speak to a lack of teacher-ready resources. Part II of this book addresses these concerns.

2.6 Games Literacy

2.6.1 Play Is the Beginning of Knowledge

> One can not teach what one does not practice. (Stroustrup, 2010)

What do teachers need to know to use games effectively in the classroom? Literacy is about having competence or knowledge in a specific area, and a certain level of literacy is important if we are going to use games just as it is with any other medium. This is important for communication between teachers, learners, parents, and administrators, but it is also important from the standpoint of credibility. I'm not sure I would want to be taught auto-mechanics by someone who had never driven a car, let alone fixed one, and I wouldn't fault the students of such a teacher for not believing them. We talk more about the importance of teachers actually playing games in Part II. For now we focus on some of the other aspects of literacy.

2.6.2 Media Literacy and Games

According to the Media Literacy Project:

> Media literacy is the ability to access, analyze, evaluate, and create media. Media literate youth and adults are better able to understand the complex messages we receive from television, radio, Internet, newspapers, magazines, books, billboards, video games, music, and all other forms of media (Media Literacy Project.org).

Video games are a form of media that is increasingly being used as a means of communication and expression. As a result, games are part of modern media literacy which in turn means that games should also be part of the media literacy component of preservice teacher training. Given that many preservice teacher programs are already chock-full there may not be a great deal of leeway for adding yet more, but some treatment of games as a media form is important, as well as adding games to the list of educational technologies.

The following is a brief overview of what game literacy for preservice teachers should include

- Introduction to the vocabulary: terminology; genres; consoles vs. handhelds vs. PC vs. mobile devices.
- Overview of what games can and can't do in formal educational settings including current literature. While it may be nice to include a history of games in

education and some of the seminal research, it is not especially useful for teachers who are about to enter the classroom, so any examination of current literature should not spend time on publications more than 5 years old.

- Places where games are being used in schools, including some specific recent examples. Again, given the rapid advances both in technology and in educational game research, examples should be 5 or fewer years old.
- Live demonstrations of some of the most popular contemporary games. While it is not necessary to become an avid gamer, it is necessary to have at least some firsthand experience playing games.
- Explanation of Serious Games: What they are, their current place in media. There is a common misconception that educational games and serious games are synonymous. While there is some overlap, they are not the same thing. Serious games are digital games designed for purposes other than pure entertainment. This is a rapidly evolving area of game development, including games designed for learning as well as games for training, advertising, politics, social justice, health, etc.
- How games can connect to formal schooling: What games do or might have potential for in the classroom; how games literacy can be used even when games are not used directly in class.

There a great many other topics that could and perhaps even should be included in a media literacy program that recognized games as part of media literacy, but this is a good start. With a basic introduction to games and their potential, teachers can go into the classroom with at least some confidence that they are equipped to use some games effectively, and to be able to critically assess others.

2.7 Summary

In order to use games effectively in the classroom, it is useful to understand something about how we learn, and there are a number of learning theories that can help us examine and analyze games for learning. We begin the chapter with a brief description of 20 learning theories that are relevant to learning with games. These are grouped into five different categories, and we look at how they can be embodied in games. Since digital games are media, we then take a look at the Clark–Kozma debate which considers both sides of the argument that media can effect learning. There really is no way to support the idea that games can be effective learning technologies without accepting that media can indeed affect learning. We then examine the claim that all games teach and saw that learning happens in all games, and the good ones help their players learn what they need in order to get through the game. The advantages and challenges of using games in the classroom are continued to be examined throughout the book, but we see a start in this chapter, and end with a look at what needs to be included in a games literacy curriculum.

In the next chapter, we look at the instructional side of games in the classroom.

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Chapter 3
Digital Game Pedagogy: Teaching with Games

"In all the works on pedagogy that ever I read—and they have been many, big, and heavy—I don't remember that any one has advocated a system of teaching by practical jokes, mostly cruel. That, however, describes the method of our great teacher, Experience."

Charles Sanders Peirce

At-A-Glance
In this chapter we see how pedagogy connects with videogames by looking at games through the lens of several known and accepted instructional theories and models. Using the premise that "good" games already embody sound pedagogy we should have little trouble mapping instructional theories onto game designs even if the incorporation of those theories was not deliberate. From these examinations we can see that learning and instructional design are compatible with good game design and vice versa. We then further expand our growing vocabulary by unpacking a typical game to see the elements that make it work.

Chapter Goals
- Explore the instructional theories and strategies that have formed the foundation for digital game pedagogy.
- Provide evidence that good games already implement sound pedagogy.
- Examine the elements that make up a game.
- Connect the dots between sound instructional design practices and sounds game design practices.

Key Terms
These are the terms introduced in this chapter. The instructional theories are summarized in the appendix, and the definitions for the terms can be found in the glossary.

- Advance organizers
- ARCS model

K. Becker, *Choosing and Using Digital Games in the Classroom*, Advances in Game-Based Learning, DOI 10.1007/978-3-319-12223-6_3

- Chunking
- Cognitive apprenticeship
- Cognitive instructional theories
- Constructivist learning environments
- Cut-scene
- Decorative media trap
- Design model
- Didactic instructional theories
- Direct instruction
- Discovery learning
- Elaboration theory
- Gagné’s nine events
- Hermeneutic instructional theories
- Information processing
- Instructional design
- Instructionist instructional theories
- Primary objective (PO)
- Problem-based learning
- Programmed instruction
- Situated learning
- Spiral instruction
- Subsumption theory

3.1 Introduction

In the last chapter, we look at how people learn from games. Now it’s time to look at how we can *teach with* games. The idea of using games in learning contexts—even formal ones—really isn’t revolutionary. In our never-ending quest to improve teaching and learning, we have often made use of whatever technologies are available to us. Why should games be different? The practice of commandeering whatever is available to help us teach may well date back as far as human communication itself. Long before we had classrooms, we taught by telling and acting out stories—sometimes with costumes and props; we drew pictures on walls; *we played games* first as live action and later with boards and playing pieces. The earliest board games that we know of are Senet and Ur which date back over 4000 years (Egenfeldt-Nielsen, Smith, & Tosca, 2008), but these are thought to have been games of chase and chance. On the other hand, live-action games and sports may well be as old as modern humans, and one of the roles of sport has always been learning.

Another way of learning that has been around for a very long time, at least in the arts, is the practice of “studying the masters” in order to learn how it’s done. This can be useful to us in trying to understand game-based pedagogy as well because even if we are on board with idea of using games to teach, not all games are “good” games, where good games are defined as those that have received critical acclaim as well as economic success. We want to be able to use games that are most likely to help us deliver on our learning objectives, so studying the masters can be enlightening. Even though most games are not designed using instructional theories as guides (Wu, Hsiao, Wu, Lin, & Huang, 2012), the theories described in this chapter can still often be recognized. By examining successful games through the lens of instructional theory, we can begin to understand the essential elements of "good" games for our purposes.

Then, armed with these essential elements, we can use them to examine educational games as well. Finally, by gaining an understanding of what is good and not so good in the games we consider, we can then create lessons using those games that take best advantage of what they have to offer. After all, there are two aspects involved in game-based pedagogy:

1. The instructional elements within the game, and
2. The lesson surrounding the game

As educators, we obviously have far more influence over the second than the first. But with the right tools for assessing games, we can at least ensure that the instructional elements within the games we use work with us rather than against us.

3.2 Studying the Masters

When we think back on the books, films, television shows and other media that have had an impact on our lives it is likely that most, if not all of them were created by talented writers, play-writes, directors, and so on. Most were created to deliver some sort of lesson or message, but there's also something else that most have in common. They were not, by and large, created by professional educators or instructional designers. What does this mean? Should we ignore what instructional design methods and theories have to say? The answer is, "Of course not." The fact that Shakespeare, or Dickens, or Spielberg was not formally trained as educators does not negate the fact that they are able to use their chosen medium to teach us something. What we *can* do is recognize the opportunities afforded us in studying these and other outstanding examples as "educational" objects, even if they weren't produced by professional educators. We should try to characterize what it is about them that makes them have the impact they do. In some ways, this is not very different from studying the great architectural works when trying to become an architect, or studying famous legal cases in law school. They are studying their masters too.

When it comes to digital games, there are some outstanding examples, but given the relative newness of the medium, there are not yet widely accepted ways to measure or compare them. Some will tell you that the Grand Theft Auto series are great games while others would be happy to see them banned altogether. So how do we decide what is a good game?

3.2.1 Choosing Good Games

Since our primary interest here is in games that can be used in the classroom, we need to establish some appropriate parameters for choosing games for our purposes. In commercial games success is usually counted in units sold, but for us that isn't enough. Just because a game is popular doesn't mean it will have potential as a game for learning. We can start to narrow the field by looking at commercially successful games that have also received critical acclaim. Again, since we are considering games for the classroom, let's leave out those games that are rated "M" (for mature) as they are likely to include mature themes and sometimes considerable violence. Unless those are the topics we're trying to teach, it is easier to stick with games rated "E" (for everybody). That still leaves us with quite a long list.

Also, because we are trying to examine the mechanisms within the game that support good pedagogy, we should also eliminate multi-player games, as it becomes too difficult to separate the learning that comes from the game from that which comes from other players. Lastly, we also eliminate sports games as many people play sports games when they already know how to play the sport, so here too it is too difficult to distinguish learning that happened in the game from prior learning. That's not to say that these kinds of games have no potential for use as G4L, merely that they are not suitable for our purposes here, which is to examine how good games and good pedagogy can overlap.

Now that we have criteria for choosing our examples, we need to look at the instructional theories and models, and see which ones are a good fit with games. This will make our job a little easier when we are ready to analyze specific games.

3.3 Instructional Design Theory

> An instructional-design theory is a theory that offers explicit guidance on how to better help people learn and develop. (Reigeluth, 1999, p. 5)

In his seminal work, Theory of Instruction, Jerome Bruner described instruction as "an effort to assist or shape growth" (Bruner, 1966, p. 1). He also suggested that we needed to include what we knew about growth and development in any theory of instruction. That is why we examined learning theories first. Now, by looking at both the learner and the environment, combined with the desired outcomes we can theorize about ways to assist or shape that growth (see Fig. 3.1).

Instructional design (*ID*) *theory* came out of synergies among learning theory, psychology, and media and communication studies. Instructional design theories are distinguished from instructional design *models* in that the ID theories attempt to explain what to do, whereas the instructional design models provide guidance on how to design it. Most design models are variations in one way or another on what I call the "universal design model," which is presented in Fig. 3.2.

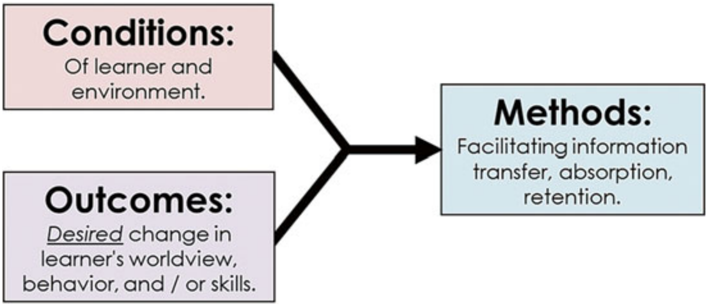


Fig. 3.1 Instructional design theories

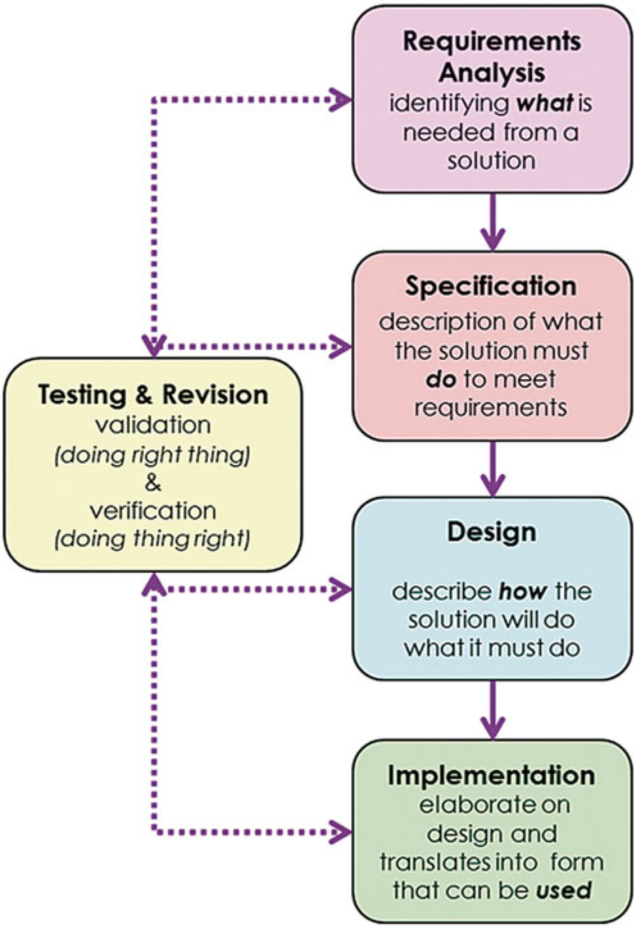


Fig. 3.2 Universal design model

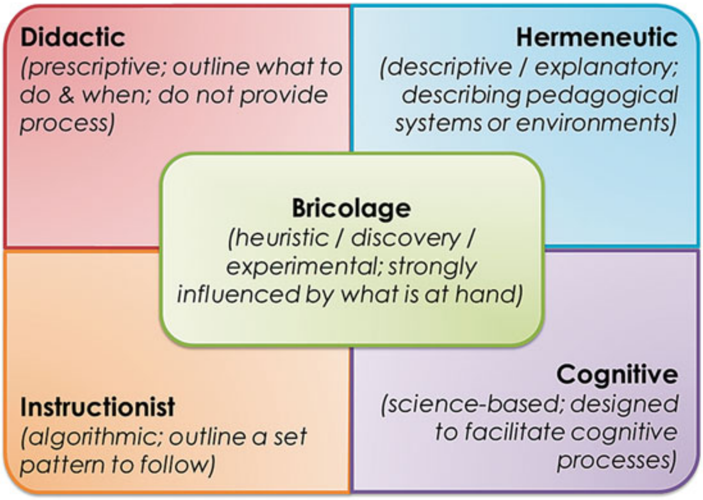


Fig. 3.3 Instructional theory categories

We will examine ID models later on in the book when we are ready to build lessons that use games. For now, we will just have a peek at the universal design model, so we can see where we are now and where we are headed. In contrast with most instructional design *models*, most instructional *theories* only encompass parts two or three of the universal design model and sometimes only the second.

Just as we did with learning theories, here we present a collection of instructional theories that relate closely to good games. In this context good games are those that help players learn the things they need to learn in order to win or get through to the end. As before, this list is also not meant to be exhaustive, but will give us a way to examine and assess games through the lens of sound pedagogical foundations. The list names 15 different theories and models, roughly categorized into five groups where each group shares distinctive properties as shown in Fig. 3.3.

The *didactic* group includes theories that provide a framework for instruction. They tend to be prescriptive in that they outline what needs to be done, often in what order, but they are still not design models in that they don't provide the process for actually creating the designs. *Instructionist* theories are often associated with behavioral training, but they can also be appropriate in many other contexts. Instructionist approaches tend to be algorithmic in style. They outline a pattern to follow during an instructional intervention. *Bricolage* is a term borrowed from architecture and art. It refers to something that is built using whatever is at hand and is used here as a category of approaches rather than as a specific design theory. The theories/models in this group are here because they are strongly influenced by what is at hand.

The next category is *hermaneutic* theories, which are those that describe systems or environments for instruction. They focus on the context rather than the procedure. All of the instructional theories in this group have also been examined in the learning theory section of the last chapter, as they address both how people learn and how

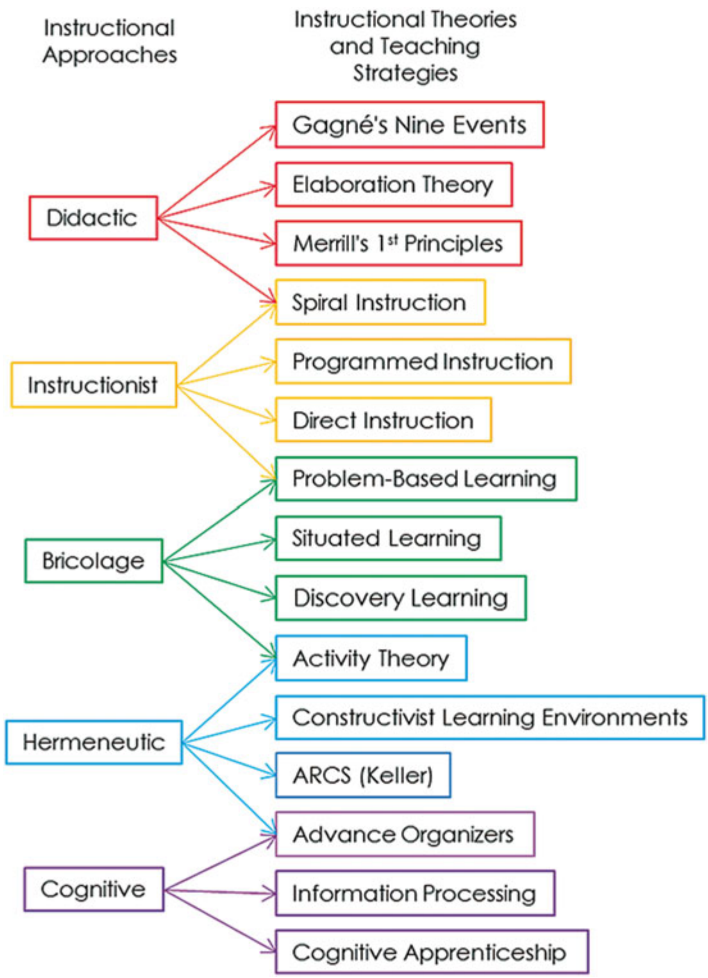


Fig. 3.4 Instructional theories and strategies

to facilitate that kind of learning. Finally, the *cognitive* instructional theories pick up where some of the cognitive learning theories leave off by offering approaches to support cognitive processes. These are approaches intended to help learners process information effectively. The list of theories discussed may be found in Fig. 3.4.

3.3.1 Didactic Approaches

The first category includes those theories we describe as *didactic*. Didactic approaches are prescriptive in that they outline what needs to be done, and in what order, such as providing an overview of what needs to be learned before diving into the lesson itself. These models provide a framework for the instruction, but are not design theories though as they don't really outline how to build such instruction, only what needs to be there.

3.3.1.1 Gagné's Nine Events

Along with Bloom's Taxonomy (Bloom, 1956), the work of Robert Mills Gagné ranks among the best known instructional theories in the field. It has the advantage of being straightforward and easy to understand. His "nine events" model shown in Fig. 3.5 unpacks the elements that make up a sound lesson, and suggests an ideal ordering for them (Gagné, 1977).

Each one of the nine events can be mapped onto many good games with relative ease although they may not always appear as distinct steps.

1. *Gaining attention* (*reception*)

   This process often begins long before the game is even released. Trailers and *demos* are important for providing advance knowledge of many aspects of a game including the style, back story, and main objectives. Just like movie trailers are designed to entice people to watch the film in the theater, game trailers are designed to entice people to buy. Gaining attention is also accomplished with the use of *cut-scenes* which are short video clips that are designed to help explain the story, the *primary objective* (*PO*), and the player's goals.
2. *Informing learners of the objective* (*expectancy*)

   It is the primary objective that should coincide with the main learning objective if this is a G4L. The roles of the narrative and PO are often confused in many educational games. When the narrative does not coincide with the learning objective, we often end up with openings like, "Learn math and help Oliver find his way home." If we need to use that math to solve Oliver's problem then that's fine, but if it is simply the fact that we got an answer correct rather than the calculation itself that helps us archive our goal we are not making effective use of the narrative. We are merely wrapping a worksheet in a decorative game and we have fallen into the *Decorative Media Trap* (see Chap. 6).
3. *Stimulating recall of prior learning* (*retrieval*)

   This is rarely done overtly in good games. Instead, the challenges in the games build up in such a way that prior learning within the game is needed in order to accomplish the next goal. Most commercial games make few assumptions about prior learning, except perhaps those that are common to all games of that type. There are some games that have steep learning curves, such as Sid Meier's *Civilization* series, but in most cases you are taught what you need to know within the game as it progresses.
4. *Presenting the stimulus* (*selective perception*)

   The way in which the content of the game is presented can vary dramatically from games that effectively talk you through what you need to do by having NPCs or a narrator explain things as you go along, to objects that glow or make noise, to allowing the player to simply explore and try things.

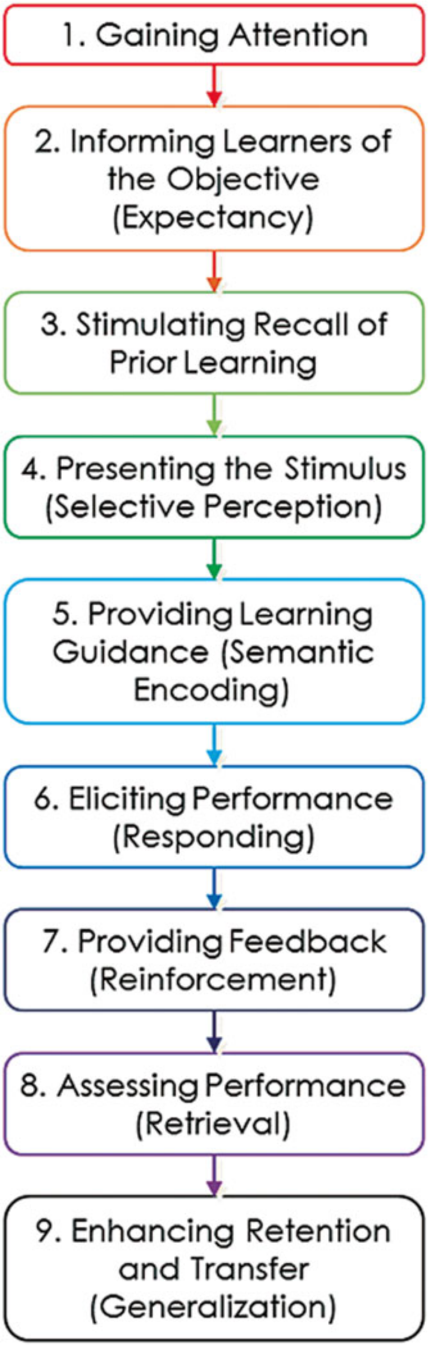


Fig. 3.5 Gagné's nine events

5. *Providing learning guidance* (*semantic encoding*)

   The point of providing guidance is to help learners encode and assimilate what they have learned. Most games provide some mechanism in the game such as an inventory where items can be stored. Once they have been viewed, cut-scenes and other parts of the narrative are also often saved so that players can review them whenever they want. In addition, many play options, items, and other things are only available at certain times when they are relevant. In this way the game supports the player without either making it too obvious or too challenging.
6. *Eliciting performance* (*responding*)

   Learners need to be given opportunities to practice what they have learned, and most games excel in this respect. In most games, players must perform to a predefined level of competence before being allowed to go on, and most of the time, the number of allowable attempts are effectively unlimited. Even if the player's character is killed or runs out of lives, they can always start again.
7. *Providing feedback* (*reinforcement*)

   This is another area where many games excel, and knowing where the player is at all times as well as their score and other status information is an essential element of what makes a game good. In a comparative analysis between *The New Super Mario Bros* (*NSMB*) and *MathBlaster*, I found that this was one of the principal aspects that set them apart (Becker, 2007a). In *NSMB*, players always knew where they were on the course and in the level, as well as how many points, lies, and power-ups they had. By contrast, the feedback in *MathBlaster* was minimal.
8. *Assessing performance* (*retrieval*)

   In addition to letting players know how they are doing as they progress through a game, most games also provide a summary once the course or level is complete, as well as at the end of the game. As is common in most games, we may lose, but we will never be prevented from trying again. A key aspect of what encourages such persistence in gamers is that we always know there IS a way to win, and that we can keep trying until we get it.
9. *Enhancing retention and transfer* (*generalization*)

   There are several levels at which retention and transfer occurs in games. The functional details of how to operate a particular game are useful primarily for the duration of that game and any sequels that might follow. Those are rarely of educational interest, but are still necessary to play the game effectively. Game genres contain similar functional interfaces as well as similar goals, challenges, and reward structures so these are often transferable from game to game. This knowledge can be useful in the same way as learning about the structure of math textbooks in a general way helps us to get to the "meat" of the next book we must use quickly. On a more abstract level, the kinds of problems solved in a game are often related such that applying what was learned in one may help the player master another.

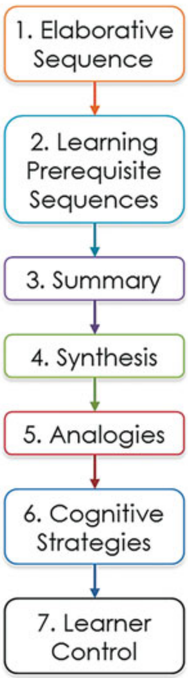
Whether it is for a long lesson or a short one, this approach includes all the necessary components for sound instruction.

3.3.1.2 Reigeluth's Elaboration Theory

Reigeluth credited Ausubel's advance organizers (1963), and Bruner's spiral instruction (1960) with laying the groundwork for his Elaboration Theory, where instruction should be organized in increasing order of complexity, and be both gradual, and graduated (Reigeluth, Merrill, Wilson, & Spiller, 1980). It is possible that the original ideas were suggested even earlier in the works of Piaget, Dewey, and Spencer. Piaget (1951) gave us the notions of the pre-, concrete, and formal operational stages of development. Both Dewey (1916) and Spencer (1891) advocated that the organization of learning should progress from simple to complex as it does for all human development. A key argument for this approach is that learners need to develop meaningful contexts to anchor new ideas and skills, and that doing so will aid in transfer and retention. One of the most critical components in this scheme is the proper sequencing of instruction. When done well, this should increase learner motivation and allow for the formation of stable cognitive structures.

Many of the concepts identified in this model, such as the importance of sequencing instruction that progresses from simple to complex remain as relevant to modern teaching and instruction as ever. When viewed through this lens, digital games have many elements that connect with an elaborative approach to learning. For example, many games have levels build on the previous ones, incorporating and building upon acquired skills and experiences along the way. Figure 3.6 shows each of the elements of the Elaboration Theory.

Fig. 3.6 Reigeluth's elaboration theory



If we examine a single game we are likely to find that one game does not use all of its available mechanisms to embody these elaborations, but in any good game, it is highly likely that each elaboration will be supported in some manner.

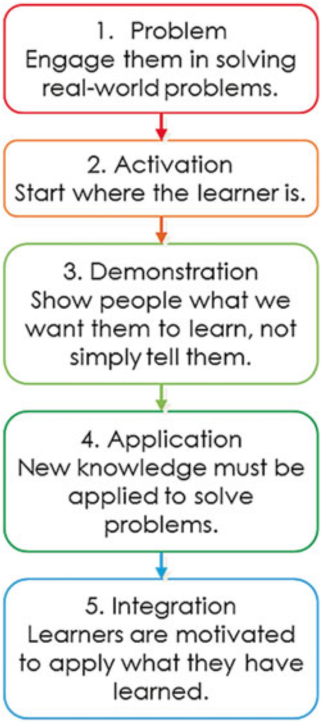
- *An elaborative sequence*—each game explains its own context (theoretical elaboration), requirements to operate (procedural elaboration), and goals for play (conceptual elaboration).
- *Learning prerequisite sequences*—most complex games offer a tutorial mode that involves some simplifications as well as suggestions.
- *Summary*—many games provide some form of "tab-sheet," or means of checking on progress with respect to what has been accomplished and discovered up to a particular point in a game.
- *Synthesis*—the implementation of this criterion tends to be fairly game-specific, and is typically evident in the way many games progress through various levels of play, each building on knowledge gained from the previous one, but can also come in the form of strategic hints.
- *Analogies*—often not evident in any one particular game, but games of similar genres have enough in common, in terms of gameplay, goals, and challenges that players create their own.
- *Cognitive strategies*—this exists by the very design of games and is one of their great achievements: the ability to force the player to use strategies invented by the designers in order to achieve their goals. Part of the challenge, enjoyment, and attraction of games is the desire to uncover the requisite strategies that allow the player to reach the "victory condition" in a game.
- *Learner control*—an obvious requirement of all games: without this, it stops being categorized as a game (Becker, 2007b).

3.3.1.3 Merrill's First Principles

Merrill's first principles represents the culmination of a long and productive career in instructional theory and design. This theory synthesizes the key elements of all the other theories and models he has developed over the years and boils them down to just five fundamental elements listed in Fig. 3.7 (Merrill, 2002).

- *Problem* "Learning is facilitated when learners are engaged in solving real-world problems" (Merrill, 2002). While Merrill emphasized the importance of solving real-world problems, it is not clear that it is the actual problem being addressed that needs to be real so much as that the application of the learning to a real-life situation must be clear. It may not always be the case that the game or problem is realistic, so this is one area where the teacher plays a vital role.
- *Activation* "Learning is facilitated when existing knowledge is activated as a foundation for new knowledge." (Merrill, 2002) This principle is similar to Gagné's third event: Stimulating Recall.
- *Demonstration* "Learning is facilitated when new knowledge is demonstrated to the learner."(Merrill, 2002) The idea here is to show them rather than simply to tell them, and this is something games do particularly well.

Fig. 3.7 Merrill's first principles



- *Application* "Learning is facilitated when new knowledge is applied by the learner."(Merrill, 2002) Merrill has complained that "(a)ppropriate practice is the single most neglected aspect of effective instruction" (Merrill, 2001, p. 464). We are often in a rush to go on to the next thing, and while we may want to do this in games too, we are often prevented from doing so until we have demonstrated sufficient competence.
- *Integration* "Learning is facilitated when new knowledge is integrated into the learner's world" (Merrill, 2002). If our learning is effectively inert, then it will fade. In games there are often things a user must learn in order to succeed in the game and in a game for learning this should coincide with at least some of the learning objectives so that actions within the game become tied to actions outside the game as well. This is discussed further in Chap. 5.

3.3.2 Instructionist Approaches

Instructionist approaches are often associated with the rise of industrialization and the work of Frederick Taylor (1911) who took a largely engineering approach to the design of classrooms and education. While this model worked quite well in the first half of the twentieth century, its applicability became less universal as we moved into the information age. It should be noted that although twenty-first century learning principles advocate for a more holistic approach to instruction, direct approaches have not entirely become inferior. There are still many contexts where these approaches can be highly beneficial.

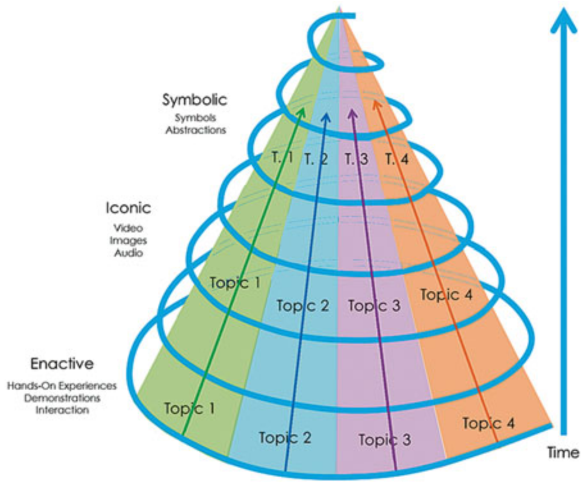
Instructionist approaches tend to be algorithmic in style, in other words they follow a set pattern or process that is effectively the same for all learners. They are often teacher-led and the content or delivery is often controlled both in timing and amount, but as will be seen, this does not necessarily mean that the instruction ends up being the same for everyone.

3.3.2.1 Spiral Instruction

First described by Jerome Bruner (Bruner, 1960), the concept of spiral instruction requires an overall coherence to the subject matter that often spans several years. The basic idea behind spiral instruction is to start with concrete/hands on/demonstrations and then progress to more abstract aspects of the topics (see Fig. 3.8). The key is that this progression is not direct—one after the other. Instead a number of topics are introduced and then they are revisited at a later time to provide further elaboration. In this way learners are given time between "visits" which allows for the information to be consolidated and connected to other things they are learning.

Many games use a spiral approach to the skills and knowledge players need to acquire as they progress through the various levels of a game. In *The New Super Mario Bros*. for example, players can complete levels using simple jumps but as they progress through higher levels the kinds of jumps needed become more complex. This is also true for a variety of maneuvers within the game.

Fig. 3.8 Spiral instruction



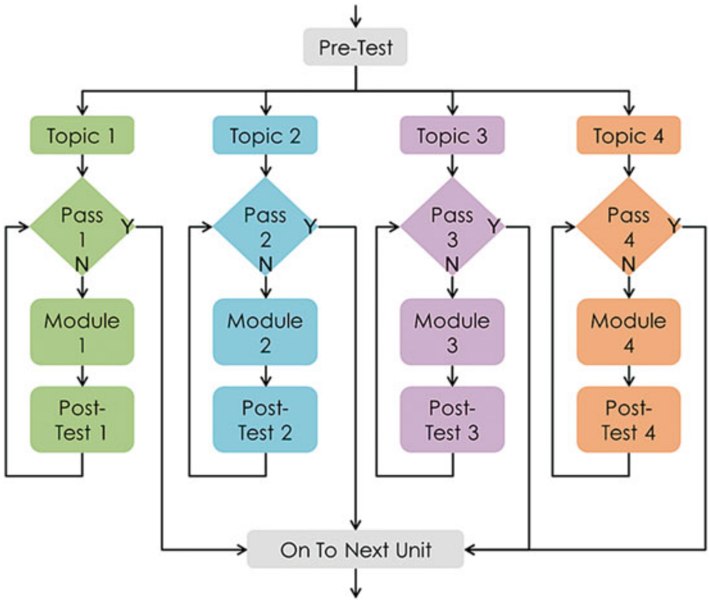


Fig. 3.9 Programmed instruction

3.3.2.2 Programmed Instruction

People learn at different rates—and individuals may learn some things faster or more easily than others. This has always been one of the great challenges in a traditional educational model. If we proceed at a rate that is appropriate for most learners, we some will inevitably be left behind and others bored. Programmed instruction (Skinner, 1968) was an early attempt to address this issue (see Fig. 3.9). With this approach, content is organized into modules usually containing sets of exercises or activities. The learner's current knowledge or understanding is accessed via a pre-test of some sort, and then they are assigned work or practice modules based on their score. The learner works her way through various modules at her own pace doing additional practice where needed and moving ahead where not.

A robust example of this sort of instruction is the Science Research Associates' SRA Reading Lab (Parker, 2013). This "lab" was first produced in the 1960s in paper form. It included a series of reading modules, each containing several very short stories along with a number of multiple choice comprehension questions. Students were able to work at their own pace and track their own progress through the modules. I remember doing these when I was in elementary school and I absolutely loved them. They included lots of detailed feedback, allowed me to control my progress and work at my own pace. As someone who was gifted, this was really important as I was typically bored when required to keep pace with the class. Similarly, those who were struggling could spend longer on the parts they needed to without holding up the rest of the class. This system is now available as an online subscription.

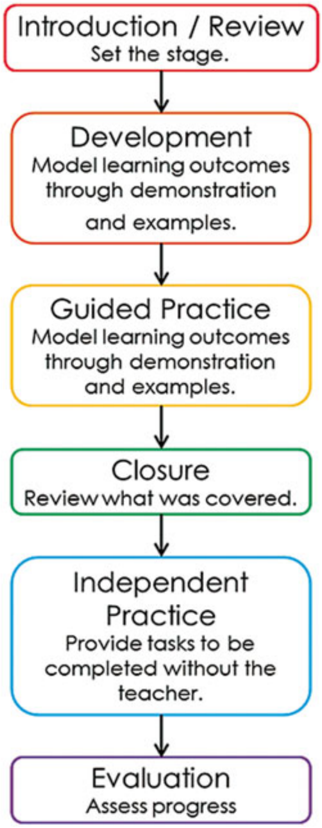


Fig. 3.10 Direct instruction

Sometimes games require the same scores or actions for all players but progress is almost always individualized, at least to an extent. If the player comes across some part of the game that he or she is already skilled at, she can get through fast and go on to something else. If not, she can stay in the same level/task as long as is needed. Note that there may be a penalty associated with spending more time on something (i.e., scores lost, or running out of time and having to start again), but players are never prevented from trying again.

3.3.2.3 Direct Instruction

Besides the apprenticeship model, direct instruction[1] as shown in Fig. 3.10 may well be the oldest form of formal (i.e., organized and deliberate) instruction. It is a strongly teacher-led approach and the primary principle that underlies direct instruction is

[1] We are describing direct instruction in the general sense, rather than the proprietary system developed by Zig Engelmann in 1964 (Engelmann & Carnine, 1982).

quite straightforward: tell your learners what you want them to know. Many drill and practice games use this strategy, and even though it is not often a recommended design strategy for games, it is one of the most frequently used ones, especially those where the game is largely a wrapper for the “content,” which is often delivered through pop-ups, and then quizzed using multiple choice questions.

In many games players may choose the degree of guidance they want the game to provide. In some games some of the hints exist or remain visible throughout gameplay (such as options). Some games will always provide extra information when the player is in proximity to an object or space that is interactive. This is often signaled through glowing outlines, identifiable icons or sounds that play (e.g., “click to use”).

Generally speaking, most games only use direct instruction during the tutorial mode when it is assumed that the player is still trying to learn how to play the game. A tutorial in a game may walk you through the basic steps but then will often let you go to explore on your own. Direct instruction is rarely used as a strategy in games except when used as hints—even then the hints are suggestions or reminders, not solutions. In fact, games that persistently provide too much guidance are often panned by players.

3.3.3 Bricolage

The word “bricolage” originally comes from the art and architecture worlds. It refers to the practice of constructing something by using whatever is at hand. By extension then bricolage instructional theories use whatever strategies and tools are available at the time. These strategies are often heuristic in nature and involve discovery and a degree of experimentation on the part of the teacher.

Some prefer to use the term “tinkering” instead of bricolage and have suggested that this sort of approach can foster reactive and adaptive designs (Dron, 2014). Bricolage is used here as a category of approaches rather than as a specific design theory. The models in this group are here because they are strongly influenced by what is at hand.

3.3.3.1 Problem-Based Learning

Problem-based learning has aspects of both instructionist and bricolage approaches. It is instructionist in that it does follow a well-defined pattern (see Fig. 3.11), but it also allows for a great deal of adaptation within that pattern to take advantage of whatever tools and resources are at hand. Problem-based learning (PBL) is closely related to both case-based and scenario-based learning. The general format of PBL will be the same for most disciplines but the details of each will vary.

PBL dates back to the 1960s at McMaster University’s medical school in Hamilton, Ontario, Canada and was developed by Howard Barrows and his colleagues (Neville,

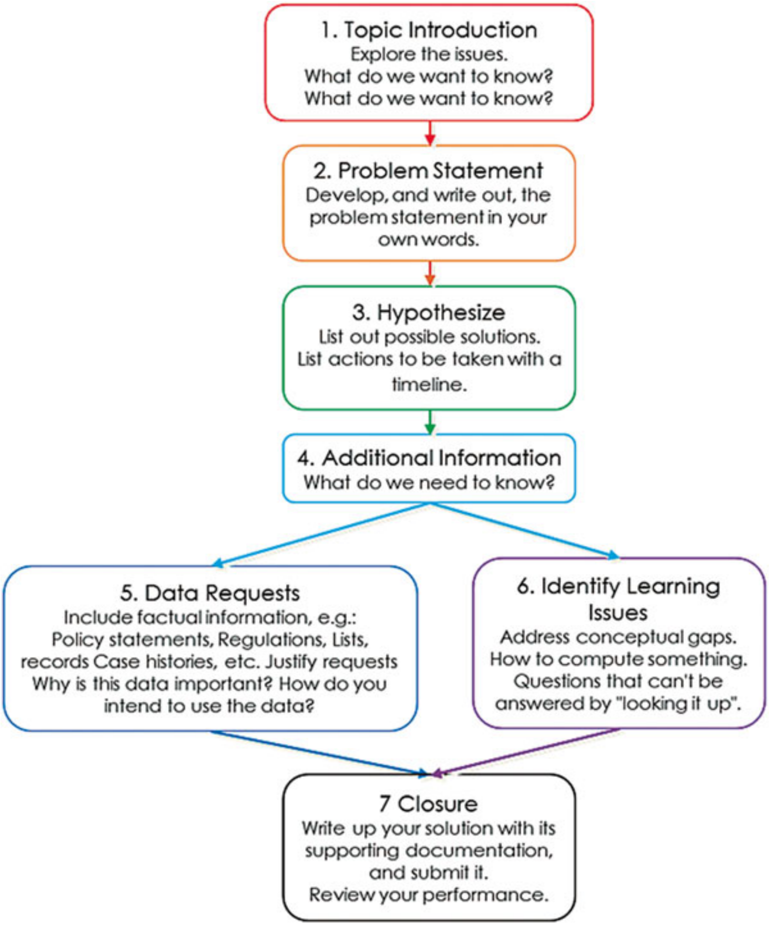


Fig. 3.11 Problem-based learning

2009). It was initially designed to support learners in making connections between what they were learning in the classroom and what they would encounter once they began to practice. Problem-based learning as a method is further intended to build on the efficacy of experiential learning and promote learning through self-directed investigation of a problem, often in role-playing or scenario based contexts (Savin-Baden, 2000). Learning is student centered and relies upon self-motivation within structures set by the teacher. Like most of the other models examined so far, PBL is a linear model that has a clear beginning and end (see Fig. 3.11).

In games, PBL is often the standard scenario for quests. Some games follow the PBL framework very closely, especially games that require the player to solve some sort of mystery such as *Phoenix Wright* and *Professor Layton. Phoenix Wright* is a crime solving game where the player must gather evidence to present at a trial, and *Professor Layton* is a mystery that must be solved in part by solving a variety of puzzles. In both of these games, players are first presented with a problem in the form of a crime or a mystery. They are often given several hypotheses to consider and then the game involves them uncovering additional information until finally, the problem is resolved. Each of the phases in a typical PBL scenario has counterparts in many games.

1. *Topic Introduction*
   Explore the issues. What do we want to know? *What do we need to know*? This is often presented to the player in games via a cut scene or the initial game introduction.
2. *Problem Statement*
   While the challenge for the game at a given level is often made quite clear, players will often reframe it to match their own knowledge, skills, and interests.
3. *Hypothesize*
   In a formal learning situation the possible solutions and a time line are often written out specifically. This is not often done when players are playing games strictly for entertainment as players will formulate and discard many hypotheses during their play, but in a formal learning setting it would be highly appropriate to have players write them out.
4. *Additional Information*
   Here too it would be appropriate to note additional needed information or resources when a game is played in a formal setting. Some games even provide space within the game itself for players to keep such notes.
5. *Data Requirements* (*facts*)
   One way of distinguishing between data requirements and learning requirements is that the data requirements deal with *what* while the learning issues are concerned with *how*. In a game like *Phoenix Wright*, which is about solving criminal cases in court, we gather facts and clues about the case.
6. *Learning Issues* (*concepts*)
   This phase gets at the crux of what we are trying to do with this learning approach. This is where we address conceptual gaps, such as how to compute something or other questions that can't be answered by simply "looking it up." In a game, this phase can often be embodied through in-game exploration.
7. *Closure*
   Finally, the solution needs to be written up. Again, this is something that players of entertainment games rarely do, but in a learning situation, this summary and reflective step is of utmost importance.

3.3.3.2 Situated Learning

Situated Learning (SL) is the first of two inquiry-based approaches that are listed as both learning theories and instructional theories. When viewed as a learning theory SL offers a theory of the place of context and culture in learning. When viewed as

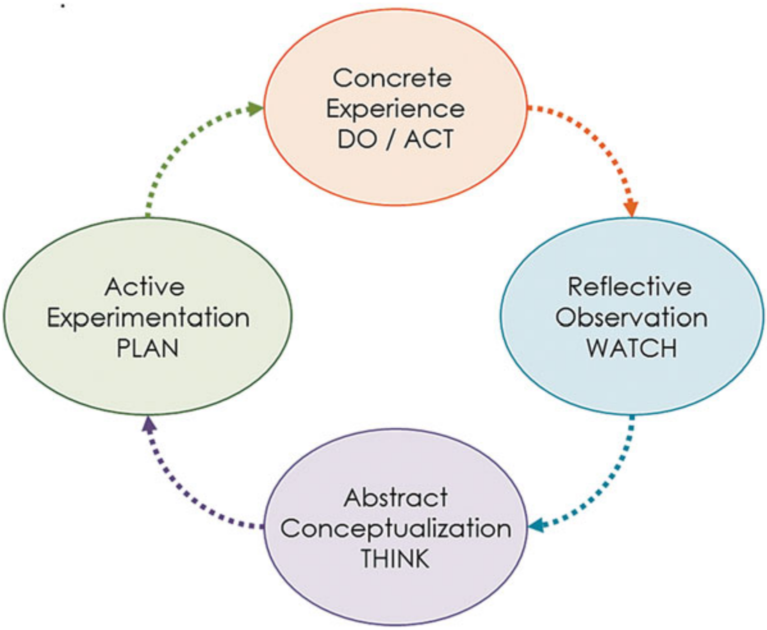


Fig. 3.12 Situated learning

an instructional theory it offers an approach to organizing instruction to facilitate learning opportunities (Lave & Wenger, 1991).

Situated Learning is said to include four phases which combine in a cyclical fashion so as to be continuous, with no requisite starting point (See Fig. 3.12). Ideally this forms a learning cycle where each round results in greater understanding, somewhat like is done in spiral instruction. A key difference is that in situated learning, the concrete experiences should be authentic and, well, *situated* in the appropriate context, while spiral instruction lacks this requirement. The four phases are:

1. Concrete Experiences, where learners interact with artifacts or act our scenarios.
2. Reflective Observation, where learners are given guided opportunities to watch.
3. Abstract Conceptualization, which is the cognitive phase, where learners can form hypotheses or models to conceptualize their learning.
4. Active Experimentation, which involves both planning and further interaction. Note that the interaction in this phase is seen to be a more informed kind than in the concrete phase.

The concept of situated learning has proved to be fertile soil for numerous other concepts, including those of John Seely Brown. Brown is a well-known organizational studies researcher who proposed a variation on SL, which he called experiential learning. He distinguished between explicit and tacit knowledge, where explicit knowledge was effectively knowing *about* something, and the tacit knowledge had more to do with knowing about the practices. It is the difference between knowing *about* physics and knowing *how to be* a physicist. His experiential learning has to do with learning how to be (Brown, Denning, Groh, & Prusak, 2001).

It is easy to associate MMO's such as *World of Warcraft* (*WoW*) with the kind of environment Lave describes (*WoW*) is a game where players typically form sizable groups, or guilds that may include dozens of players who cooperate on quests. The players' experiences are very clearly situated within the game environment. Communities of practice (CoP) also readily form around single player games such as those that form around the Civilization series. This series of games is quite complex and it can take many hours to become a competent player. Here CoP often form so players can help each other get better at the game, as well as to discuss and reflect on their experiences playing the game.

Games are a natural fit with situated learning. Obviously the situatedness is largely virtual as the experiences of the player happen indirectly through the actions and characters in the game, but it is there nonetheless. When approaching games from this perspective it would make sense to begin with the concrete experience (DO/ACT), which would in many cases be the gameplay itself. That is followed by reflection. This will usually come from the formal educational context. It is usually teacher lead. Reflection is then followed by abstraction, although a more fitting label in game-based learning might be "realization." While ideas and concepts may be abstracted within the game, they will also be connected back to the real world. The fourth phase will involve planning and possibly further in game action to explore, enact, or verify theories that come out of the abstract conceptualization phase as well as to confirm ideas.

3.3.3.3 Discovery Learning

Discovery learning is the other inquiry-based approach discussed in the previous chapter. As a learning theory, it explains the learning that happens through experimentation, and as an instructional theory it lays out how we can facilitate such learning.

Discovery learning (DL) is related to both Spiral Instruction and Situated Learning in that there is a somewhat cyclical aspect to it but DL also includes the ideas of scaffolding and transfer. Whereas spiral learning returned to the same topics repeatedly, going into more depth each time, DL fosters an environment where learning about one topic can be transferred to others as shown in Fig. 3.13. It consists of four main phases through which learners progress. The first is an experiential phase where learners interact with the objective in some concrete way. They are then prompted to reflect on the experience. From there they propose generalizations and abstractions that will help them to transfer what they have learned to other spaces.

It is common, especially in adventure and role-playing games such as the *Final Fantasy* series, for players to explore the available environments and simply try stuff. By going around and seeing what can be opened, collected, and manipulated, the player learns about the environment and acquires skills that can later be used to complete quests and accomplish other in-game goals. While spiral learning is perhaps the

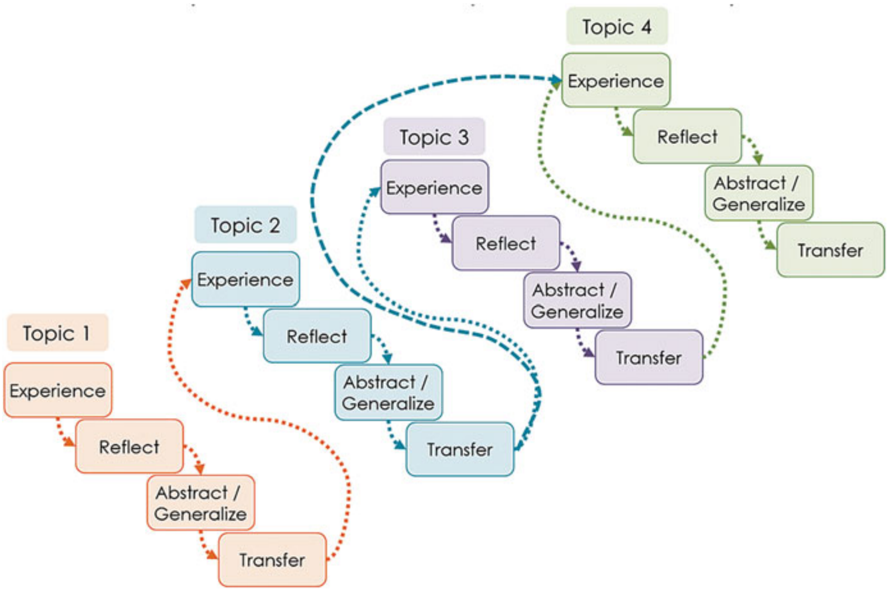


Fig. 3.13 Discovery learning

best fit for the learning that facilitates progression through a game's levels, discovery learning is an ideal fit with the kind of learning that happens as players gather skills and knowledge that will be put to use in other contexts throughout the game.

3.3.4 Hermeneutic Approaches

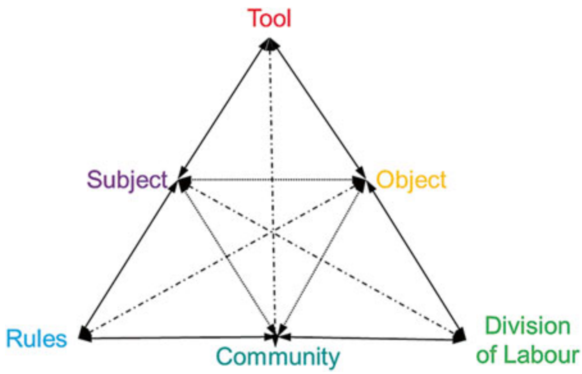
Hermeneutics deal with the art and science of interpretation, so this next group of theories is all primarily descriptive. They interpret relationships among and connections between various elements of an environment or system. The chosen theories for this group include Leont'ev et al.'s Activity Theory, Jonassen's Constructivist Learning Environments (CLE), and Keller's ARCS model. All describe systems or environments that are thought to help create ideal conditions for learning.

3.3.4.1 Activity Theory

Activity theory is an approach that is also discussed in the previous chapter. As a learning theory, it explains how learning is affected by the interaction between the learner, the goal and the available tools, and as an instructional theory it lays out how we can organize environments to facilitate such learning (See Fig. 3.14).

Activity theory originated in the Soviet Union in the 1920s and early 1930s and was put forth by Vygotsky, Leont'ev, and Luria (Leont'ev, 1978). It arose out of a

Fig. 3.14 Activity theory



desire to take better account of the fact that human activity is always situated in a context or an intersection of several contexts and so must be understood within those contexts. While similar to situated learning (SL), activity theory pre-dates SL and includes a more detailed breakdown of the components of the environment. Activity Theory is a "philosophical framework for studying different forms of praxis as developmental processes, with both individual and social levels interlinked" (Spasser, 2007).

it is relatively easy to see how a game that is played through an avatar embodies the contexts described in this theory. Using *Animal Crossing New Leaf* (*ACNL*) as an example, we can see how such a game maps onto each of the elements:

Subject

The main subject of any game is the player of course, and in ACNL players may take on several characters, but not simultaneously. This game is played from a third-person perspective so the player, while likely identifying with their character, sees that character act within the game. This perspective adds a degree of distance for the player as the play experience is more akin to playing with a doll than pretending to be someone else.

Object

In ACNL the choice of object affects how the game will best be played, although this game does encourage some activities more than others. The main ones include: relationship building, collections, money making, the "stalk" market (the commodity of trade is turnips), and gardening (which includes fruit and money trees as well as flower breeding that can result in the production of various new colors). Different approaches are appropriate for different objects, but they are all introduced early in the game, after which the player is free to focus as desired. Players need not commit to any specific goal and may change their focus as often as they wish.

Tools

Tools serve as mediating elements in any activity and can be physical, conceptual or symbolic. They include instruments, signs, procedures, machines, methods, laws, and forms of work organization (Jonassen & Rohrer-Murphy, 1999). If we stretch the notion of physical to include in game artifacts with which the player can interact, then all three exist within many games. ACNL has a great number of artifacts and objects but not many classes of objects, and even fewer actual tools (shovel, watering can, etc.) that can be used to achieve goals. Conceptual tools include such things as humor (Dormann & Biddle, 2006), relationships that develop between the player and the NPCs with which we interact and over which we have varying degrees of influence, and the use of time, which can be considered a mediating tool as well as having ties to the games rules. At its most fundamental level, the entire game is a symbolic tool of course, but when we look at symbolic tools within the game we find such things as special events, changing seasons, lucky furniture items, silhouettes of fish seen underwater, and so on. All of these artifacts can be used by the players to support progress towards the object and outcome.

Rules

Without rules, a game really isn't a game, and in a role-playing game such as ACNL, those rules tend to be fairly complex. ACNL has both explicit and implicit regulations, norms, and conventions that constrain individual action and group interaction. There are positive or negative consequences to almost every action, although in this game the connection between the act and the consequence is often not direct. For example, one can increase one's "luck" when fishing by placing lucky items in our house. Fish appear at random according to a predetermined probability but this can be positively affected to a certain extent by our own actions. Lucky items placed in our house increase the likelihood of the appearance of rare fish.

Rules of interaction both with the game environment and with the NPCs are enforced in ACWW largely by restricting the user options and also by the way in which the NPCs respond. If we ignore or deflect requests for interaction by residents too often they are likely to stop giving us gifts, for example. Residents will move out of our town from time to time, but how we respond to them will often affect when this happens. Since there is no single win state in this game, there is also no single lose state, and the game can continue indefinitely providing essentially endless opportunities to try again even without restarting the game.

In ACNL, game time is intended to match real time and certain events take place on a regular basis (weekly visits by occasional characters, daily replenishment of the shopkeepers stocks, annual special events, etc.). These events are tied to the game's calendar and clock and although players can adjust the clock forwards and backwards, each day that is "skipped" still exerts influence. For example a lack of interaction with the residents will prompt many of them to move away.

Rules underpin all progress in digital games. They govern progress by judging if progress has been met or not and provide consequences.

Community

In ACNL there are a number of regular residents (such as Tom Nook the shopkeeper), as well as occasional visitors and villagers. The town regulars are largely benign and will help out according to their roles, while the occasional visitors are largely beneficial (although a few are scoundrels!) and each of these also has specific roles as well as peculiarities. Conversations are not free form and in fact very few modern games offer anything but the most rudimentary forms of language recognition. Most conversations involve a predetermined (or randomly selected) phrase that is displayed, followed by several potential responses from which you may choose.

Division of Labor

The division of labor in a game activity system comes from the ways in which the community is organized. In most games the division of tasks between members of the community is quite well-defined and it is not uncommon for individuals or groups to exist specifically to serve tightly defined roles. In ACNL the regular residents have roles associated with a specific space. Occasional visitors have similarly specialized roles but tend to be more mobile. In games this mechanism helps to compartmentalize the behaviors and possible actions, thus controlling the game design's complexity while at the same time allowing for player flexibility. From a learning perspective each character and location becomes associated with specific activities and acts as a mnemonic that players can remember thus providing a scaffolding effect.

3.3.4.2 Constructivist Learning Environments

David Jonassen was a prominent force in the area of constructivist learning and his theories and ideas continue to have significant influence. Learning through games can provide the kind of constructivist environment Jonassen spoke of (Jonassen, 2004). In his work on designing constructivist learning environments, Jonassen describes the essential qualities of CLEs as an interconnected web where each element connects with every other element. He outlines eight essential qualities, all of which are interrelated (see Fig. 3.15), and each of which is embodied to some extent or another in well-designed games.

The eight qualities necessary to constructivist learning environments are:

1. *Active/Manipulative*: This idea is very closely aligned with learning by doing. Interactivity is really at the core of most games—without it, they really aren't games.

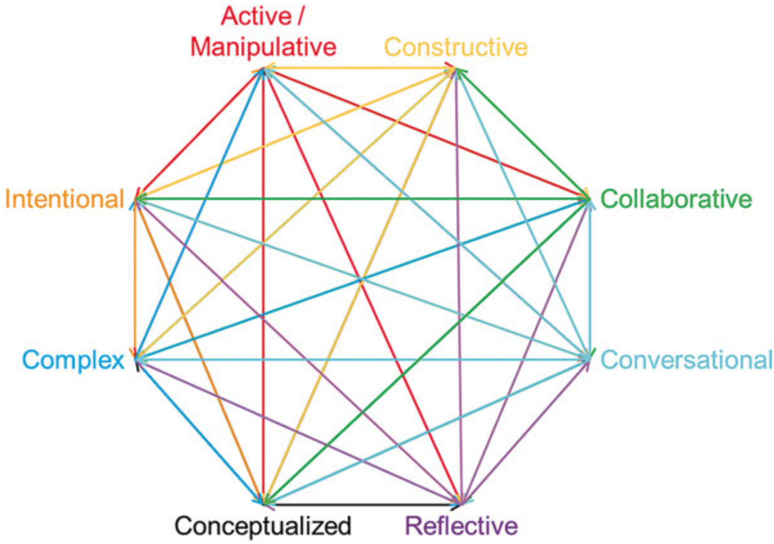


Fig. 3.15 Constructivist learning environments

2. *Constructive*: Learners are meant to construct their own meanings and in this games often excel: games rarely "preach." People learn in games by trying things in line with their own constructed models, and then experiencing the consequences.
3. *Collaborative*: Games have always included a social element, even in the early days when *Pong* first hit the consumer markets. Single player games are routinely enjoyed by small groups of friends, where one plays, and the other watch and "advise." Today, more and more games support multi-player modes, and massively multiplayer games have made it possible for many thousands of players to be involved in the same game simultaneously.
4. *Intentional*: Learning must be goal-based, and in gaming this amounts to a tautology: part of what makes something a game is that is has a goal, or victory condition.
5. *Complex*: Jonassen claims that we have a tendency to oversimplify problems for learners and that this does them a disservice as they are capable of handling greater complexity than we often give them credit for. A brief conversation with almost any child involved in a game like *Railroad Tycoon*, or *Zoo Tycoon* will verify that they are well able to cope with the complexity of a problem as ill-structured as building and maintaining a public animal park.
6. *Conversational*: Learning is inherently social, says Jonassen, and at the risk of belaboring the point, so are many games.
7. *Contextualized*: This point speaks to the situated nature of effective learning. Again, this is a recurring theme among many of the theories featured in this volume. Virtually all of the learning that happens in typical commercial games is situated, and just in time. For the most part, people learn as they play.
8. *Reflective*: People like to consolidate what they have learned by talking, writing, and just thinking about it. This last point is evidenced in games, not so much

within the games themselves, but certainly in the communities that have sprung up around and in support of the games. There are discussion groups, help facilities, groups who regularly come together outside the game to discuss and exchange ideas.

3.3.4.3 ARCS

ARCS is a motivational theory that arose out of a desire to understand and influence the motivation to learn. It was first developed in the late 1970s by John Keller (Keller, 1996). While related, it differs from Self Determination Theory in that it outlines a temporal order for the elements rather than relationships between them.

Each of the four major categories of motivation which is described along with numerous strategies can be used to solve motivational problems in these areas (see Fig. 3.16). The categories are listed below, along with a brief example of how this can be implemented in a game.

Attention—Attention can be influenced through incongruity or conflict, such as playing devil's advocate or through something concrete such as a case study. It can also be influenced by varying the approach, using humor, or through prompting inquiry or participation. Just as it would be inadvisable to use all of these strategies

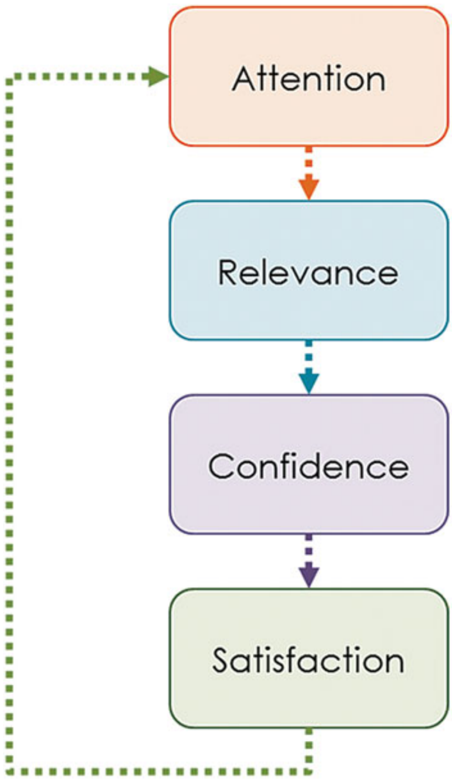


Fig. 3.16 ARCS model

in a single lesson, we are unlikely to see all of these embodies in a single game, although different games use different strategies, often to great effect.

Relevance—Making learning relevant to learners is thought to be an important motivator and Keller outlines several strategies that can help. Drawing on past experience, explicitly telling learners how this will benefit them, or stating the value of learning the content can all act as motivators. This element can also include providing choice, opportunities to interact and use what is being learned, and modeling success. These are the kinds of things often done in the introductory scenes in games and when hints are being offered.

Confidence—Most successful games are very good at helping players build confidence. Keller's strategies include providing clear requirements, increasing difficulty as the learner/player improves, and allowing players to set a variety of goals, encouragement, and promoting self-confidence are all embodied in many games.

Satisfaction—Finally, incorporating natural consequences, providing occasional unexpected rewards, promoting positive outcomes while minimizing negative influences, and providing appropriately timed reinforcements are standard practice in most successful games.

3.3.5 Cognitive Approaches

These theories pick up where some of the cognitive learning theories leave off by offering approaches to support cognitive processes. These are approaches intended to help learners process information effectively and includes Advance Organizers, Information Processing, and Cognitive Apprenticeship.

3.3.5.1 Advance Organizers

Both John Dewey and Herbert Spencer advocated that the organization of learning should progress from simple to complex as it does for all human development. Bruner also advocated the organization of learning in increasing order of complexity (Bruner, 1966). Ausubel used this notion to help form his *subsumption theory* and the concept of *advance organizers* (Ausubel, Hanesian, & Novak, 1978). Subsumption theory proposed that new learning was subsumed into existing learning, and that instruction needed to be organized to facilitate that. Ausubel believed that students must relate new knowledge to what they already know if they are to effect meaningful learning. He also believed that learning proceeded in a top-down manner, with general concepts first and only later proceeding to more detailed ideas. An advance organizer is something that can help students link their ideas with new material or concepts. It is designed as the "mental scaffolding" to learn new information, and is classified as one of four ways in which new information can be presented:

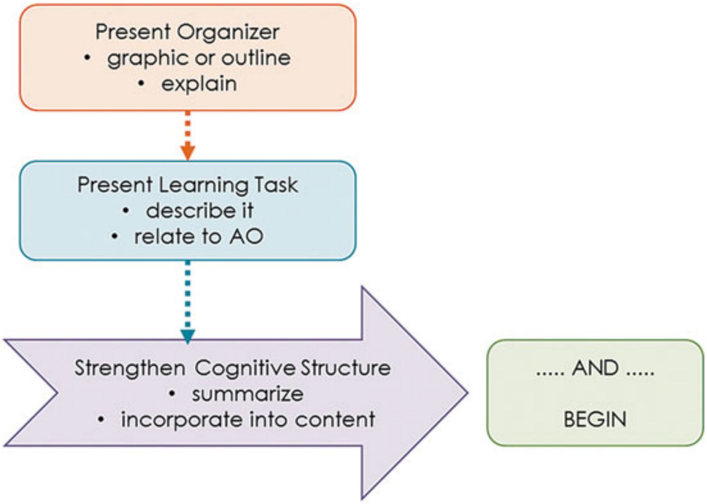


Fig. 3.17 Advance organizers

1. Expository Organizers intended to provide a description of new knowledge.
2. Narrative Organizers that present the new information in a story format.
3. Skimming Organizers that flick through the information.
4. Graphic Organizers that include pictographs, descriptive or conceptual patterns and concept maps.

In whichever form, the advanced organizer consists of three phases as shown in Fig. 3.17.

The first advance organizer in a game with some sort of story usually provides the background of the story along with the main goals. This may be accomplished using any of the approaches described for advance organizers, but is most commonly done with some sort of cut-scene or narrative combined with images, video, and sound. Often these are of a higher production quality than the game itself. A new level or other challenge may also begin with what could easily be recognized as an advance organizer.

3.3.5.2 Information Processing

> I don't burden my memory with such facts that I can easily find in any textbook. (Frank, Rosen, & Kusaka, 1947, p. 185)

George Miller gave us some very useful ideas about the capacities of human working memory, such as the *magical number 7 +/− 2* (1956) for how many things we can hold in working memory, and the idea of *chunking* (ibid.) as a means of combining things into groups to enable us to consider them as single things—both of which can be used to great effect in designing games—but when applied too universally the idea that our brain is a computer becomes a dangerous analogy. We are NOT computing devices and attempts to explain human cognition only in terms of a discrete machine creates a semiotic domain that is too limiting to be of value in work with games. Nonetheless, Miller's ideas have had a noticeable impact on how instruction can be organized and presented.

The key concept behind information processing is that we have different kinds of memory: a sensory memory that stores sensory information from some external stimulation after the sensation has ended. It is considered to be the shortest of all. Some of what is remembered here will get transferred to short-term memory. This is an organic version of a scratch pad. Short term, or working memory is thought to last anywhere from 15 s to about a minute. If we are to remember something longer than that, we must either keep activating it in our short-term memory through repetition or rehearsal, or transfer it to our long-term memory, which, under ideal circumstances, is permanent. That process of transferal is in essence what we call learning, and so the theory of information processing is about how to organize instruction to facilitate the transfer of information into long-term memory (see Fig. 3.18).

One of the big challenges when designing instruction is deciding which things we should remember, and which, to paraphrase Einstein, can easily be looked up in a textbook. These days, of course, it is even easier to look things up, and so the question becomes what should we commit to memory, and what we can leave on our devices or out there in the digital cloud. Games often provide a variety of tools to help us remember things, from maps, to inventories, to collections of images, documents, or videos, and even utilities that allow players to make notes. Players are not restricted to tools provided by the game itself, and can also create external notes, maps, lists, and so on to keep track of things they don't wish to commit to memory. In commercial games, it is the game designers who decide which things players are encouraged to remember by providing incentives and sometimes penalties. For example, in the *Professor Layton* series, if a player forgets what an NPC has told them, they can usually return to the place where that NPC is and prompt them to repeat what they have said. It takes time, however, and sometimes puzzles that would have been presented in a particular place are moved to the puzzle vault if the player does not come across it the first time they are in that location. In this game the penalties are largely ones of convenience, but they exist just the same.

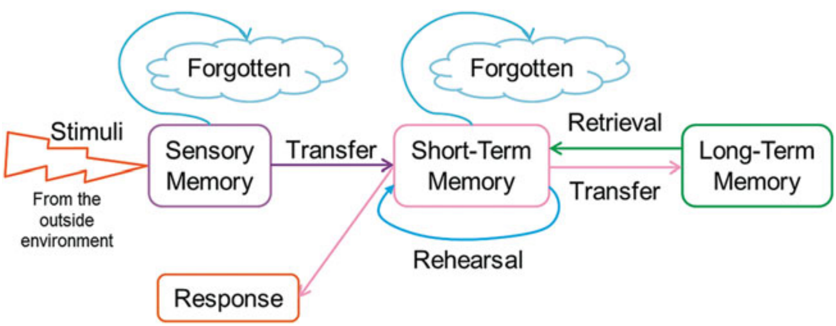


Fig. 3.18 Information processing

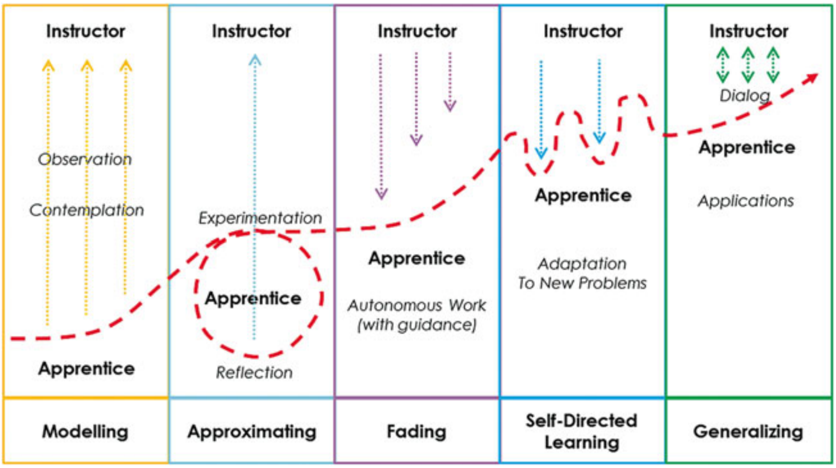


Fig. 3.19 Cognitive apprenticeship (Mai, 2011). Used with permission

3.3.5.3 Cognitive Apprenticeship

First proposed by Allan Collins and John Seely Brown in the late 1980s (Collins, Brown, & Newman, 1987), this theory is based on traditional apprenticeship learning where apprentices learn through successive iterations of observation and practice. It was originally proposed as a way to teach reading, writing, and mathematics. It consists of several phases beginning with the instructor as the active agent progressing through to the final phase where the learner has become the most active agent. Figure 3.19, originally created by Erin Towsley (Mai, 2011) presents a view that includes a typical path of progress. In the modeling phase, the apprentice observes the instructor demonstrating the processes. It may also include some explicit instruction.

In the next phase, the apprentice may go through numerous iterations of experimentation followed by reflection with the topic which may be guided. As the learner's skill increases the instructor's direct participation fades until the apprentice begins to adapt whet she has learned to new problems. This phase of self-directed learning often still includes interjected periods of assistance from the instructor until finally the apprentice begins to approach a level of equality with the instructor. In that final phase, the instructor and apprentice interact more as peers do and what was coaching evolves into dialog.

There are numerous games that employ a crude form of apprenticeship, some of which are more obvious than others. *Black & White* is a game where the player is allowed to make various moral choices which affect a population of villagers over which the player has influence. In this game the "instructors" come in the form of two spiritual advisers: one good and one bad. There is a fairy named Navi in *The Legend of Zelda*: *Ocarina of Time* that acts as a guide to the main character Link by providing hints, tips and information about other characters that are encountered.

Numerous games make use of helpful NPCs, but given that entertainment games are supposed to be fun for the player, a tool that provides too much guidance is likely to make the game less fun so their influence is often limited. However, the precedent exists, so it is possible to make more use of the avatar as master/coach/helper without losing the feel of an authentic game. Our ability to incorporate adaptive agents into games is still somewhat rudimentary, but as our understanding of machine learning continues to advance, so will the “intelligence” of our NPCs, and in-game guides.

3.4 Game Elements

The Institute of Electrical and Electronics Engineers (IEEE) defines a learning object as “any entity, digital or non-digital, that may be used for learning, education, or training” (IEEE, 2002, p. 3). Learning objects may be big or small, traditional or not, but most of the time when a learning object is built specifically for that purpose its structure will be a recognizably educational one. In other words, it will follow many of the accepted norms for curricula, courses, and lessons. One of the challenges in examining commercial games as learning objects is that nether structure maps conveniently onto the other. Game designs and instructional designs both come in many shapes and sizes, but both forms have more structures and elements in common with other designs of their own domain that they do with designs of the other. There are various structures in both domains that serve specific purposes within those domains. Assessments in instruction may include quizzes or formal exams for example, but one would rarely find an exam in a video game even though the players are routinely “tested” as they play. Examining video games, even ones designed specifically for learning, requires an understanding of game design elements so that we can identify how they connect to instructional theory and design. In aid of that the following terminology (see Table 3.1) is included as reference and to clarify how the terms are being used in this volume. While this is not a complete list of game elements, the terms listed in the Table 3.1 relate directly to the instructional approaches and strategies we are talking about.

3.5 Summary

Discussions of game-based learning often encompass all aspects of the use of games for learning, but it can be useful to consider learning with games from various perspectives. This chapter looks at game-based pedagogy, which we have defined as the theory and practice of teaching with games. There is some overlap with game-based learning to be sure but as we have seen, game pedagogy is associated with a different set of theories and even theorists and the point of view is that of the teacher, whereas the point of view for game-based learning is, or at least should be that of the learner. Figuring out how to use videogames as effective learning objects

Table 3.1 Brief glossary of structural game elements

Game element	Description
A.I. Artificial intelligence	The core "engine" of the game that embodies the game's rules and conditions for winning, as well as how the characters within the game will interact with each other.
Attract mode	This mode is the one that runs when the game is on but not in a state of active play.
Back story	The story that underlies the game, and sets the stage for the main game goals.
Boss challenges	These are challenges (often physical conflicts) with a major opponent and often mark the final challenge of a level or the entire game.
Cut scenes	Short video clips that are designed to help explain the story and the player's goals.
Game mechanics	The mechanisms by which the player achieves the goals of the game.
H.U.D. Heads up display	The display board that contains the game's vital information such as the player's score, statistics (health, assets, etc.), current game conditions, and so on. This may also include a map and other information.
L.O.D./P.O.V. Level of detail/Point of view	Games typically allow players to change the level of detail by zooming in or out. It may also be possible to change the point of view so players can see what is behind them or look at objects from a different angle.
Levels	Somewhat similar to chapters in a book, levels are parts of a game that contain one or more complete challenges.
N.P.C. Non-playable character	A character that appears in the game with which you may or may not be able to interact but whose behavior is determined by the game's design. These characters are not controlled by the player.
Narrative	The ongoing story as it does or can unfold. It is what comes after the back-story, often adding to it.
Outcome	The outcome is the final state of the game.
Perspective	This is the viewpoint that the player has when playing the game. There are five major perspectives: First-Person (player as character); Third-Person ("over-the-shoulder"); Top-Down (bird's-eye view); Isometric (tilted top-view; slightly to the side); Side-View (two-dimensional horizontal view)
Sandbox mode	Practice mode, where scores do not count towards a win.
Story mode	That part of the game where gameplay is "on-rails," meaning that the player has little to no control over where they go and what tasks they attempt.
Time: actual and game-time	The passage of time in games may change between actual real-world time and accelerated, skipped, or even slowed game-time.
Trailers	These are the game advertisements, often containing cinematic quality clips, screenshots of actual gameplay, and other dramatic devices to give potential players an idea of what the game is like.
Tutorial mode	In this mode the player often receives direct guidance, visual, verbal, and otherwise from the game. This mode's purpose is to help the player acquire sufficient knowledge and skill to manage the basic gameplay.

(continued)

Table 3.1 (continued)

Game element	Description
Valorization	Different values are assigned to different outcomes within the game; some are winning outcomes (better) and some are losing outcomes (worse).

For a more detailed explanation of these terms, see the Glossary

requires an understanding of what it is that make good games good, and one way to do that is to look at the best examples, in other words to study the masters. This chapter looks at 16 instructional theories that have relevance to teaching with games and provides examples of various games that embody those theories in whole or in part. These instructional theories combined with the learning theories of the previous chapter give us lenses we can use to look at videogames from the perspective of teaching and learning. We are now ready to begin looking at games in earnest, starting with commercial off-the-shelf games (COTS).

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Part II
Choosing Games

Chapter 4
Commercial Off-the-Shelf Games (COTS)

> *"Computer games don't affect kids, I mean if Pac Man affected us as kids, we'd all be running around in darkened rooms, munching pills and listening to repetitive music."*
>
> *Gareth Owen*

At-A-Glance

While there appears to be a growing acceptance of the use of games for learning (G4L), this acceptance is often focused on games designed specifically for learning, in other words, serious games where the educational purpose of the game is explicit and was likely part of the design goals right from the start. When it comes to using COTS games in the classroom, acceptance is still somewhat lagging—often with good reason—though there are some noteworthy exceptions.

Whether a game is intended for use in formal education (K-12, and Higher Ed, higher education, preschool), in corporate training, or other professional development, the context and activities surrounding the game are key in reaping whatever potential benefits a particular game may offer. Using a COTS game in a formal learning context is, in most cases, analogous to an "off-label" use. We use them knowing that this is not what they were designed for and so we must recognize that the efficacy of these games will inevitably come from a well-matched pairing of learning design outside of the game and directed or goal-oriented play within the game.

The aim of this chapter is to discuss the opportunities and challenges involved in the use of COTS games to help educators achieve this pairing between COTS and the classroom. We start off by explaining how digital games are distinct from traditional games and highlight some of the implications that result.

Chapter Goals

- Examine the advantages and challenges specific to using COTS games
- Look at a few examples

Key Terms

These are the terms introduced in this chapter. Definitions for these terms can also be found in the glossary.

K. Becker, *Choosing and Using Digital Games in the Classroom*, Advances in Game-Based Learning, DOI 10.1007/978-3-319-12223-6_4

- Close Playing
- Commercial Off-the-Shelf (COTS)
- Decorative Media Trap
- Digital Divide

4.1 Introduction

While there appears to be a growing acceptance of the use of games for learning (G4L), this acceptance is largely focused on games designed specifically for learning, in other words, serious games where the educational purpose of the game is explicit and was likely part of the design goals right from the start. When it comes to using *commercial, off-the-shelf* (COTS) games in the classroom, acceptance is still somewhat lagging, but according to the US Department of Education, this may soon change as games become accepted as educational technologies (Crecente, 2015). In 2013 US President Barack Obama laid out a goal to empower educators with the best technology and cutting-edge tools to enrich the learning experience for American students. In response, Games For Change combined forces with the US Department of Education to host the first Games for Learning Summit in April of 2015 (http://tech.ed.gov/games/). It would appear that the use of games for learning is poised to become mainstream technology.

This chapter looks at the opportunities and challenges associated with the use of games in learning contexts that were designed primarily or even exclusively for entertainment purposes. Some of the games originally designed for entertainment purposes are now being recognized for their potential value in formal educational contexts, but since they were not designed with education in mind, it can be challenging to match learning objectives to them.

Whether a game is intended for use in formal education (K-12, and Higher Ed, higher education, preschool), in corporate training, or other professional development, the context and activities surrounding the game will be key in reaping whatever potential benefits a particular game may offer. Using a COTS game in a formal learning context is, in most cases, analogous to an “off-label” use. We use them knowing that this is not what they were designed for and so we must recognize that the efficacy of these games will inevitably come from a well-matched pairing of learning design outside of the game and directed or goal-oriented play within the game. This kind of approach to using non-educational objects is not uncommon though; we have been doing this with literature for a very long time. In fact, using a game as literature is one of the three chief approaches to using COTS games in the classroom. Games are primarily used in formal education in one of the four ways:

- For the content within the game
- For the story (i.e., as literature)
- As media
- For the code and design of the game itself

The use of games as media does not present the same kinds of challenges as their use as literature, since the game is being studied as the artifact rather than for something it communicates. Because of that, it doesn't really count as game-based learning. The last use is found mainly in computer science education and is quite specialized, so it will also not be discussed here, but the first two will be as they have broad application throughout formal education.

4.2 Digital Games Are Special

Before we go any further we need to be clear about the similarities and differences between traditional or analog games and digital ones. We defined the terms in the section on talking about games in Chap. 1, but now that we have a clearer picture of both game-based learning and game-based pedagogy, it's time to have another look.

Digital games are special. They share properties with both other kinds of software and with analog games, but aren't a straightforward evolution of either. They are more of a gestalt in the sense that the total effect of a digital game goes beyond that of either software or of analog games. Having a better understanding of the distinctions will also help us in our quest to make the best possible use of the games we choose for our classrooms. Let's look at them in turn (see the summary in Table 4.1).

Model of Original System

All games are based on a model of some sort of system. This model includes a representation of the system, its variables, behaviors, and their interrelationships. In digital games any parts of the model that are to be mediated by the game itself must be painstakingly and precisely defined because all of it must be controlled by the programs that make up the game. In a complex game, this can amount to millions of lines of computer code. By contrast the original system in a traditional game can leave many aspects of the model implied without ever explicitly stating them. The ancient game *GO* for instance has very simple rules and an equally simple goal. Two players take turns placing their stones on the intersections of a grid on a board try to capture as much territory as possible by surrounding it with their stones. It is however an exceedingly difficult game to master, with a great many subtleties in strategy. There are also games such as some role-playing games that have very elaborate descriptions of the model to the point of having dozens of books outlining various characters and scenarios, but many board and card games are based on models that can be described reasonably well in a few paragraphs in the rule sheets.

Rules

In a digital game the rules must be completely predetermined, and they are enforced by virtue of the fact that they are hard coded, meaning that they must be part of the game program logic. When there is an oversight in the rule structure, the game can become unwinnable. For example, *Pikmin* is a game where you are asked to enlist the help of little creatures called pikmin to find pieces of your spaceship that were strewn about when you crashed on this planet. One item you must retrieve is something called a Libra, which sits high atop a large cliff side in the Forest

Table 4.1 Digital vs. non-digital games

	Digital	Analog			
	Digital games (and simulations) (ALL)	Board and card games	Analog simulation games	Analog role-playing games	Live action role-play (including cosplay)
Model of original system	Painstakingly and precisely defined	Many details taken for granted and never made explicit			
Rule structures	Predetermined	Negotiable			
Rule enforcement	Hard coded	Uses "honor system"	On the fly		
Participants	There need only be one human participant	All participants are human			
Roles	Accurate placement into context	Imagined, personally mediated	Determined by game rules		Imagined, personally mediated
Environment	Dynamic—same for all players	Static—unchanging	Combined static physical artifacts (boards and pieces) AND imagined		Imagined, personalized
Environment resolution	Dynamic	Static physical	Relatively static	Relatively static	Individually mediated
Game objects	Can be autonomous	Either inert or mechanical			Imagined (can include props)
Game interaction	Consistent across all instantiations of the game	Consistent *only if the rules are followed*			Each instantiation can be different

Naval. You can get it down without problems most of the time, but there is a small chance that your pikmin will misstep on their way back down and fall over the cliff, taking the Libra and themselves to the abyss below. The Libra won't *respawn* in its old spot, and you can't win the game if you save at this point. You need all the vital parts at least to win, let alone all the ship parts, and Libra happens to be vital. This was not an intended outcome designed by the game makers but was instead an oversight.

Rules are also often designed very carefully in analog games, but they will rarely be rendered unwinnable should a situation arise that the designers didn't anticipate. In an analog game, the players can add or modify rules on the fly. It is quite common to change the standard rules of a game when someone is just learning to play, for example. Expert players may handicap themselves by starting with fewer pieces when playing against a novice in chess for example, and many who played Monopoly as kids invented new rules or modified the standard ones to make the game easier, or harder, or simply more entertaining.

When it comes to how the rules are enforced, here again, in digital games the enforcement is hard coded, and determined by the game developer, whereas in an analog game rules are enforced using an honor system. In other words, players agree to abide by the rules. While it is quite impossible to cheat at computer solitaire, our history and indeed our novels, films, and even songs have plenty of examples of people who decided not to follow the rules in poker!

Participants

It is assumed that at least one participant in any game will be human, whether it is an analog or a digital one, but after that, other participants in a computer game can be NPCs which are part of the game and its programs. In an analog game, all participants are human. The roles played by the participants in a digital game are, like almost everything else, determined by the designers, whereas the roles played by players in an analog game are personally mediated. Sometimes they are wholly imagined. In role-playing games entire volumes (books) are sometimes written describing the various roles that can be played.

Environment and Objects

Here the distinctions for analog games must be subdivided by category. Board and card games normally have quite simple environments which are not alterable. This has been a real boon to the board game industry who is able to sell a game like Monopoly in a whole slew of variations where really the only thing that changes is the pictures and names on the board. Analog simulation and role-playing games often involve a combination of static physical artifacts such as boards, markers, and playing pieces, but they can also take a blended approach by including imagined environments. At the far end of the spectrum lie live action role-playing games which rarely have any static physical artifacts (other than the costumes) and the entire environment is imagined—even though it may be played within a real one like a city or forest. In that case, the real world acts as the set, including other people who happen to share the same space but are not playing.

In a digital game the environment, like everything else, is designed, developed, and controlled primarily by those who made the game. While it may be beginning to sound like having everything designed and controlled by the game makers would make a digital game seem limited, the possibilities are in fact quite astounding. As we know from some of the games we have talked about already digital game environments that are not constrained by real-world limitations. We can have fantastical worlds populated by creatures that we as players would never have imagined. We can defy gravity or become superheroes, and any given aspect can change in whatever way the game makers created—space can turn instantly into ocean, and giants can shrink to the size of a microbe. Objects too can come to life or change into something else.

Game Interaction

Another way in which analog and digital games are different is in the way we interact with the game—in other words what people can do in the game. It is important to remember that just because the interaction in a game may be consistent doesn't mean that the experience of playing the game will always be the same. If that were true, there would really be no need to play any game more than once, but even I can play computer solitaire over and over again. In fact, this is why a game like Tic-Tac-Toe rapidly loses its appeal—not only are there a fairly small number of total variations possible, but as soon as the players realize that it is possible to block their opponents progress, every subsequent game is likely to end in a tie. A game that is predictable is rarely any fun.

When it comes to what people can do in a game, live action and other analog role-playing games have a tremendous possibility for delivering a unique experience since each and every instantiation of a "game" is created and controlled by the players. Board and card games deliver consistent interaction only if the rules are voluntarily followed, but the interaction in a digital game will be consistent across all instantiations of that game—no matter where, or when, or who plays it. This can be a huge advantage for us when using a game for learning because in that sense, the game is predictable, and predictability of interaction is a very useful tool in learning.

4.3 Fitness for Purpose

Just like any other educational object or technology, one size doesn't fit all. Different kinds of learning environments will have different criteria for the design and use of games. When considering COTS games for the classroom, fitness for purpose is key. In other words we need to make sure that the games we choose and use are going to meet the needs we have. We should know what to look for and what to out for. It is easy to be fooled into thinking that a game has potential for use in the classroom, especially if it *looks* nice. This is what I call the *decorative media trap*, which is the mistaken belief that a pleasing, pleasant, or impressive appearance implies that the artifact is well designed and will be effective. We will learn more about that in Chap. 6. For now, let's look at some of the reasons we might choose a COTS game, and then we'll look at some of the challenges that are unique to these kinds of games.

4.3.1 Advantages to Using COTS Games

We already touched on some of this in Chap. 2 when we looked at game-based learning in general, so let's briefly review our list and see which ones still apply when we consider COTS games.

- **Cost**: *Given adequate access to computers or mobile devices, games can be cost effective.*

  Very often when games are made specifically for educational purposes they have different licensing agreements from those of commercial games. Commercial games are typically sold individually or by subscription, but G4L tend to offer educational and site licenses. Having to buy individual copies of a game for an entire class or school can become quite expensive, so in this case cost may not advantage COTS games over G4L. That said, an increasing number of publishers recognize the value of getting their COTS games into the classroom and many will fashion custom licenses or modify existing ones to help make their game affordable for schools.

- **Risk**: *Games offer opportunities to play out roles that would not be possible in real life.*

  This aspect applies to COTS games as well, but with a caveat. Since these games were not designed with formal education in mind, they may contain content that is unwelcome or even verboten in classrooms. *Assassin's Creed* is an example of a game that contains accurate historical information about the Renaissance, but as the title suggests, players play as an assassin tasked with finding and killing various individuals. It is possible to "turn the blood off" to make it less gory but it is not possible to play as something other than an assassin, so that may make it unsuitable even though the content is sound. While it may be true that so long as the game being used is age appropriate there is unlikely to be any content in the game that the learners have not already seen in the games they play for fun, on television, or elsewhere in their social networks. Still, it is something that needs to be considered. If you are in a school where certain topics are not acceptable for classroom discussion, then it is important that games be carefully vetted to make sure that they don't contain unacceptable material. Fortunately, many games, especially popular ones, have substantial Internet communities and finding out whether a particular game features certain kinds of violence or certain kinds of sexual content is usually not that hard.
- **Exploration**: *Games offer opportunities to try out scenarios that would not be possible in real life. They allows to explore those "what if" questions—especially if transgressions are involved.*

  Here again we need to consider the fact that content in COTS games is not normally vetted with schools in mind. Yes, players can try out all kinds of interesting scenarios, but if you want to use this game in class, it would be useful to know what kinds of "transgressions" players can enact in a game you want to use.
- **Time**: *In games, we can speed up and slow down processes to allow learners to experience continental drift, or a nuclear reaction.*

  This applies to COTS games as well—players can sometimes live out multiple lives in the course of one play through a game or they can play in a "moment in time" for the entire duration. It all depends on the game.
- **Scale**: *Similarly, we can interact with a system on a universal scale, or a microscopic one.*

  This is also true, but many if not most COTS games play out on a more or less normal human scale. Players play the role of people, so the environments reflect that. There are a few, such as *Psychonauts*, where parts of the game are played out from inside the character's head, so it is possible.

- **Games allow for continual assessment**. *Everything a player does in a game can be tracked: the choices they make, the places they go, and how long they stay there.*

  Here is one place where COTS games tend to diverge from G4L. It is true that COTS games often have sophisticated assessment methods, but they are rarely aligned with accepted or mandated educational standards, so here we will need to build some bridges.
- **Rapid feedback**: *Feedback is normally instantaneous, or at least easy to access.*

  The same comments apply here as were made about assessment in general. While this is true of COTS games, the kind of assessment may not be immediately usable in a formal educational context. The relative value of the feedback varies from deep to shallow as well.
- **Abstraction**: *It is possible in games to embody any concept, process, or relationship and to allow the player to interact with it.*

  This is true of COTS games, especially when we look at games made by smaller independent ("indie") developers. The "indie" developers are in many ways comparable to independent film makers. Many are small companies or even individuals who do not expect to get rich from their games. They tend to produce smaller games that take more creative risks. As a result, this is an area where it is possible to find unique games with unusual perspectives.

What can we add? You may have noticed that I have avoided mentioning the fact that kids like games and working on computers. Most people nowadays accept that this is true, more or less. While the sentiment is not universal, most kids do like playing games and most do not find technology daunting—most grew up surrounded by it after all.

There is one advantage to games that has not yet been mentioned and that many games offer players considerable autonomy. It is even one of the qualities that distinguishes good games from bad. A good game will offer the player with a variety of choices and different ways to achieve the goals, and while the game may have time pressures built into various challenges, players are rarely prevented from trying as many times as they need in order to succeed. Because of this, learners playing a game may feel less pressure than they might from some other approach.

4.3.2 Disadvantages to Using COTS Games

On the downside, there are considerable challenges to using COTS games in the classroom, at least some of which are shared with almost any other media object that was not specifically designed for education.

Coming back to the challenges, one of them is finding games that map well enough onto the curriculum to justify the time spent using them. There are a few games available where this is not the case and we will look at one or two in as examples later, but in most cases there is little or no teacher support, so those who want to use COTS games in the classroom are left to their own devices when it comes to finding ways to integrate them into an already tight curriculum.

Another challenge is that not all teachers or learners are gamers, so they may not feel as comfortable using games as they would some other technology. They will potentially be at a disadvantage compared to gamer students due to their lack of how to play games, though they may fully understand the desired concepts. On the other hand, gamers could potentially beat the game without actually grasping the concepts, so this is also something that needs to be kept in mind. Then again, on the *other* hand, we have a growing number of people both among the students and the teachers who do not read very much for pleasure, so the same could be said of reading novels for English; yet that hasn't stopped us. There are no current curricula based on digital games, so those who use them are in some sense breaking new ground. This is of course how we progress, but it isn't always easy.

Another potential concern is that not everyone will learn most effectively through DGBL. Here again this is a phenomenon that is not unique to games. While there is no clear evidence to support the notion of multiple intelligences, it is well accepted that people have preferences. Some people prefer to learn with information that is presented primarily in visual form, while other prefer verbal form, and others still prefer to read things on their own. Most classroom nowadays try to present material in multiple formats to address these preferences, so the use of games can be viewed as simply adding one more modality to an increasingly rich learning environment.

This next challenge is a little more difficult to dismiss as it requires more than a simple attitude shift. The lack of computer access including the time needed to play these games as well as the assessment required to meet mandated standards are challenges that are part of the still ever-present *digital divide*. Those districts and schools that have the resources to provide computer or mobile access for their students will have a distinct advantage when it comes to using COTS game over those who can't. Often the use of a COTS or any other serious games assumes that students will be able to access the game out of class in order to play it. In areas where students typically don't have their own devices or where they lack access to broadband Internet, this can create insurmountable problems that do not happen if students can be given textbooks, novels, or take-home handouts.

Last on our list is the lack of research supporting the efficacy. While few people question the effectiveness of textbooks and direct teaching—even though there are few studies testing this, games do not get the same acceptance and administrators, parents, and other stakeholders often demand proof of effectiveness before sanctioning the use of a game. This is especially true of COTS games as they were not designed to be educational. What I can offer as counterargument is that teachers have been making use of whatever technologies and media are available to enrich their classes, whether or not the research had caught up. Here as with many other approaches to teaching in the classroom, teachers are blazing trails by finding and trying new ways to use games. The lack of formal research supporting various approaches has never stopped innovative teachers from trying them.

Still, we use literature, theater, film, TV shows, music, and other media in school all the time. Some choices are controversial, and others are well accepted. From this vantage point at least, games are no different. But, just as digital games are distinct from analog games, so too are they a distinct form of media when compared to other literary forms. The experience of a game is quite different from that of the others. Perhaps most importantly games are interactive while all of the others are essentially linear. They also require more in the way of technological support. This adds to the challenges, but can also add to the benefits as we will see when we look at the next two sections.

4.3.3 Games for Content

When people think of using games for education, they usually think of the content of the game: it may teach facts, allow players to experiment with some phenomenon, or present some kind of problem that needs to be solved. This is the most common way to use games in the classroom and there is a growing number of examples that we can look at. Some of these will be looked at in more depth in the example section. For now, we will whet your appetite by offering these brief examples. The following examples are all uses that have either been tried in classrooms or proposed by teachers attempting to fulfill a need.

4.3.3.1 Angry Birds

Even if they've never played it, most people will have heard of *Angry Birds*. It is a game where the player launches cartoon birds at various structures containing little pigs using a catapult. If the player manages to bring down the structure before using up all the ammunition, they win the round. The physics of the launch are quite realistic, and that lends itself to experimentation and examination of real physics using the game as illustration and practice in mathematics and physics. It's been used to teach kinematics in middle school (Rodrigues & Carvalho, 2013) and to teach parabolas and vectors in a high school pre-calculus class (Lamb, 2014), to name just two examples. Carvalho et al. (2011) used screen and video capture software combined with a video analyzer to allow students to record the bird as it is launched through the air, and then make various measurements of the resulting images and videos to explore fundamental concepts such as position, trajectory, and movement. Lamb (2014) used the trajectory paths taken by the birds in the game as examples of parabolas. Both also used the game as an opportunity to discuss the importance of establishing appropriate units of measure.

4.3.3.2 Civilization IV

(Civ4) is a turn-based strategy game developed by Firaxis Studios. Players control one of several civilizations. Each has its own particular strengths and weaknesses. Some are more scientific, for example, while others have stronger cultural or military attributes. Players start with a single village in the Stone Age and must advance from there by exploring, finding cities, researching, exploiting natural resources, and eventually trading or making war with neighboring civilizations. In this example, Pagnotti and Russell (2012) used the game in a grade-nine social studies class. The lesson spanned five class periods, and the primary focus was the exploration of the relationship civilization development has with the advance of technology. A secondary goal was to expose the students to the economic concepts of production capacity, distribution, and the allocation of scarce resources. The results were very encouraging. Students were highly engaged and the resultant interactions and conversations showed a significant degree of sophistication.

4.3.3.3 The SIMs

SimCity, Will Wright's resource management game where players get to be city planners, is probably the first game to receive broad acceptance as a COTS game that could be used to be effective in formal education. It was used in social studies classes in the late 1990s, and is still in use today. One instructor used *SimCity* to create a simulation for a college course on introductory American Government (Woessner, 2015). While *The SIMs* series does not enjoy the same popularity in education as *SimCity* did, there are still a number of noteworthy applications. One approach was to use it for language learning (Purushotma, 2005). Since *The SIMs* is in many ways much like a dollhouse, the environments of the game are much like the kinds of families and situations often featured in typical language learning texts. Many games allow players to choose the language used for settings, dialog, and other feedback. Objects such as houses and furniture can be modified and annotated in the SIMs as well. By taking advantage of these features, it is possible to set up the game to be played in German, for example. The teacher can add annotations to various objects which could include translations. Another use of *The SIMs* also takes advantage of its dollhouse like environment as a therapeutic tool for young people in residential care in Ireland (Aventin, Houston, & Macdonald, 2014). The game provides a space where participants can act out various scenarios. Residential social workers were able to create situations in the game for the youth and could then use it to provide guidance in emotional regulation and skill coaching.

4.3.3.4 FIFA Soccer

Sports games are among the most realistic when it comes to the animation and the way that the characters on the screen behave. This is important because most people who play these games are fans of the real-life (RL) games as well and know the players depicted in the game. In a DGBL class I taught in 2005, one of the students designed a set of lessons around the *FIFA Soccer* game that was meant to help English-as-a-second language learners. Soccer is a sport that the adult students he taught would be familiar with—therefore the in-game commentary had a ready-made context. Additionally, as is typical for many games, certain moves within the game trigger certain predictable reactions and comments from the NPCs within the game. When the game is played in English, these comments (phrases) can be elicited at will and that repeatability can be a big advantage to someone struggling to learn a new language (Wang, 2006).

4.3.3.5 Roller Coaster Tycoon

Another similar group of games set of lessons for a high-school remedial math course that used *Roller Coaster Tycoon*. This is a game that involves strategy to develop, market, and manage a commercial theme park. If the players manage the park well, then they will attract and maintain satisfied customers. In this set of lessons, the students worked in groups to develop their amusement parks, but needed to keep track of different variables outside of the game that were then used to create spreadsheets and charts that were compared against others in the class (Becker, 2007).

4.3.3.6 Assassin's Creed

This game would seem to be an unlikely candidate because as its name implies, *Assassin's Creed* is a game where the player plays the part of an assassin who must kill various targets. *Assassin's Creed 2* is set during the time of the Renaissance, and the third in the series is set during the crusades. The game developers have made a special effort to make sure that the historical aspects of the game are accurate, in part because they knew that some games were being used in classroom settings. It has potential for use in a history or social studies class studying the Renaissance because of this historical accuracy. According to Ubisoft Public relations director Michael Beadle, "(e)ach game has a database where players are able to further explore and learn about key historical moments they have played through or about a building they just passed or climbed. … History is a core component of the *Assassin's Creed* franchise and one that we know has taught millions of players over the years about key characters and historical events by experiencing pivotal moments in history" (Starkey, 2015). Many historians can still find numerous inaccuracies, but given the game's popularity, this can lead to teachable moments that students might actually remember (Trépanier, 2014). Aside from pointing at the inaccuracies, it is also possible to use this game as a way of examining the changing nature of historical research (LeJacq, 2016). Given that this game is quite violent, it is one that would only be suitable in more senior classes.

The key aspect to all of these uses of COTS games is that each application made use of a property of the game that was specifically useful to the subject being taught or the purpose of the game. The in-game physics of *Angry Birds* lends itself particularly well to measurement and experimentation; the people in *The SIMs* can act as stand-ins for real situations, thereby providing a way to examine them indirectly.

4.3.4 Games as Environments

Another way to use games is as a kind of laboratory where demonstrations can be set up, and where experiments can be performed. The two games described in this section are cases in point. Both of these examples are discussed further in Chap. 7 where the games are reviewed. *Minecraft* is also used as the feature game for a grade-one semester plan example in Chap. 10.

4.3.4.1 Minecraft

Another game that has become quite popular as a tool in education is *Minecraft*. *Minecraft* is a virtual world where players can build their own environments using Lego-like blocks that can be colored to look like almost anything. It's being used primarily at the elementary and middle-school levels for math, geography (Scarlett, 2015), creative writing, art, and more. Students can build models of buildings and other structures they are studying in history, scenes from stories they are reading, entire ecosystems, or single cells (Dikkers, 2015). *Minecraft* can provide a place to collaborate on building projects without all the fuss of having to clean up at the end of the class (Overby & Jones, 2015).

In one study, the children's knowledge-making dialogs were recorded while they were playing the game and helped understand their self-, other-, and object-regulation strategies (Wernholm & Vigmo, 2015). Given that it is an environment for world-building, its potential applications to constructionist approaches to learning would seem quite broad indeed (Schifter & Cipollone, 2015).

It has also been used for math, history, and geometry. This virtual world has become popular enough to spawn several websites devoted to helping educators use the game in their classes as well as to share what they have designed including one created by the developers of *Minecraft* that includes a special edition of the game specifically designed for education (Minecraftedu.com).

4.3.4.2 Portal

Portal was a small game that was originally bundled with the initial release of *Half-Life 2* in a set called The *Orange Box* that included a *Half-Life* expansion game, and *Team Fortress 2*. *Portal* is a first-person action puzzle game where the player must solve puzzles by creating portals through which they can pass various objects. What made this game unique was that the portals connected one chamber to another in unexpected ways. For example, a player could open a portal directly ahead that was connected to another directly below the player. When an object was tossed through the forward portal, it would immediately come out of the connecting portal underneath, all the while maintaining the same momentum. Players recognized the educational potential of the game, and here too the publishers got on board by creating a version specifically for education, and supporting it with a website called Teach With Portals (teachwithportals.com). It provides numerous lesson plans in physics, math, and others. Students can create portals to create oscillators, study the in-game gravity effects of friction on movement, and even pose questions to explore experimentally and gather data.

4.3.5 Games as Literature

Another way to use games in the classroom that is just beginning to gain some popularity is to treat them as literature, as Darvasi (2015) has done with the game *Gone Home*. Obviously, games that are to be used in the same way as literature will almost always be ones that have a narrative. They don't necessarily need to be long, immersive stories; after all we also study short stories, poetry, and prose as well as novels. We study literature to help us understand the human condition. We study literature to learn about the power of words and the ways they can be used to tell stories and have an impact on those who read them. We study literature to experience the lives of others and to learn from them. The same can be true for games. Many games have deep and complex narratives, and these can be experienced, explored, and studied for the same reasons we study literature.

Games are as much a medium of expression and communication as any other media, so there should be no reason to treat them differently. Janet Murray commented on this topic nearly 20 years ago when television was firmly established as a popular medium and the idea still carries weight here:

> We often assume that stories told in one medium are intrinsically inferior to those told in another. Shakespeare and Jane Austin were once considered to be working in less legitimate formats than those used by Aeschylus and Homer. One hundred years after its invention, film art still occupies a marginal place in academic circles. The very activity of watching television is routinely dismissed as inferior to the activity of reading, regardless of content (Murray, 1998, p. 273).

It is interesting that television in all its forms is still seen as less legitimate than film or literature, but there are now many series that are studied and discussed in school, so there is progress.

As was mentioned earlier, the experience one gets from a game is quite different from more linear media, so depending on your goals, this can be seen as either a disadvantage or a unique opportunity. The experience that games provide is also often an individual one because unless the entire class is watching one person play, each player will have his or her own experience that is unlikely to be exactly the same as anyone else's. In addition to exploring our own interpretations of a literary work, learners can now also explore unique variations of the narrative, often generated by the choices made as players. Examining games as literary works is not yet very common, but as games begin to mature we are seeing more games with rich and distinct narratives, such as *Gone Home* which will be discussed in some detail in the next section.

Games can also be used more generally to encourage reading and comprehension, as was done in this study by Brock Dubbels (2008). He worked with a group of struggling seventh and eighth graders by setting up an after-school videogame club. He noted that students struggled with many of the same problems in the games as they did when reading other literature, but were more willing to explore and learn what they needed to proceed in the game than they were when dealing with traditional texts. This may not seem like a significant finding, but a willingness to persevere is thought to be a key component in gaining mastery of one's own learning (Zimmerman & Labuhn, 2012), so this could be important.

Another way that games are currently being used in a literary fashion for learning is as inspiration for creative writing. For this the games would ideally have intriguing narratives and inspiring visuals. Here too we have a growing number of games that could fit the bill, such as *Journey*, a game where the player travels through a desert to a distant mountain and can only communicate using a chime rather than text or speech. A game such as this that lacks dialog but that has a detailed story allows for a wide variety of interpretations. Students can put to words a narrative that exists only visually and musically in the game.

4.3.5.1 Gone Home

Gone Home is a mystery game set in a mansion with no clear goal, other than to try and find out what happened to everyone in the house. The game begins with a note on the door from the player's sister who is also gone but who asks that you (her sister) tell no one what happened. The game space opens up as she discovers more clues. *Gone Home* has earned critical acclaim for its story and as a result it has also garnered attention as a literary work. This makes it an ideal candidate for study as literature through what is becoming known as *close playing*, which is an adaptation of the idea of a close reading, involving a careful and critical interpretation of a narrative. The blog LucidLearning documents one approach to a close playing of *Gone Home* in a high-school English class (Darvasi, 2014). Students played through the game and studied the character development, and its "archaeology," or how the setting and objects found in the game portray the time period of the game (mid-1990s), the music, and other videogame references. Although not all students enjoyed the game their reports and assignments clearly indicated that all had played through the game rather than an online summary or study guide. According to Darvasi, "(t)hey delved into the text, drew their own critical conclusions about it and responded in kind. Despite the unusual choice of text, or site for analysis, their learning outcomes were consistent with the skills demanded by lit class curriculums from around the world, including Common Core State Standards" (2015).

This example is discussed further in Chap. 7 where the game is reviewed, and also in Chap. 10 where an example unit plan is developed using *Gone Home*.

4.4 Summary

COTS games are primarily used in one of the four ways in the classroom:

1. For the content within the game—for its facts or the experience it provides.
2. For the story—as literature to use for literacy practice, creative writing inspiration or to study as a literary work.
3. As media—as an artifact within the context of media studies, popular culture, psychology, or some other discipline.
4. For the code and design of the game itself—as software to be studied, emulated, or implemented.

This chapter concentrates on the first two. In this chapter we looked at the advantages and challenges that relate to the use of COTS games rather than ones made specifically for learning. There are some unique challenges to be sure, but there are also some advantages, which are summarized below:

Advantages:

- **Cost**: *Given adequate access to computers or mobile devices, games can be cost effective.*
- **Risk**: *Games offer opportunities to play out roles that would not be possible in real life.*
- **Exploration**: *Games offer opportunities to try out scenarios that would not be possible in real life. They allow to explore those "what if" questions—especially if transgressions are involved.*
- **Time**: *In games, we can speed up and slow down processes to allow learners to experience continental drift, or a nuclear reaction.*
- **Scale**: *Similarly, we can interact with a system on a universal scale, or a microscopic one.*

- **Games allow for continual assessment**: *Everything a player does in a game can be tracked: the choices they make, the places they go, and how long they stay there.*
- **Rapid feedback**: *Feedback is normally instantaneous, or at least easy to access.*
- **Abstraction**: *It is possible in games to embody any concept, process, or relationship and to allow the player to interact with it.*
- **Autonomy:** *Players can often have control over how fast they learn and often even in what order.*

Challenges:

- **Mapping**: *COTS games do not always map easily onto mandated curricula.*
- **Inclusion:** *Not all teachers or learners are gamers.*
- **Individual learning preferences:** *Not all people like games.*
- **Computer access:** *(a.k.a. digital divide) While some schools have one-to-one programs where every student has a laptop or mobile device, other schools still struggle with getting enough computers and maintaining them so that their students can have adequate access.*
- **Lack of research supporting efficacy:** *A Lack of research "proving" effectiveness can make it more of a challenge to convince administrators, parents, and other stakeholders that teachers should be allowed to incorporate games into their curriculum.*

In order to get a better feel for how COTS game can be used for their content we finished by looking at a few examples.

References and Resources

Resources

Minecraftedu.com. http://minecraftedu.com/
TeachWithPortals.com. http://www.teachwithportals.com/
Wikia.com. http://www.wikia.com/Wikia—A wiki that includes a large number of game wikis

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Chapter 5
A Magic Bullet

"(I)nstructional technology only works for some kids, with some topics, and under some conditions—but that is true of all pedagogy. There is nothing that works for every purpose, for every learner, and all the time."

(Mann, 2001, p. 24)

At a Glance
This chapter describes my magic bullet model for analyzing the learning in a game. It diagrams the learning balance and with it we can conceptualize how the balance of the various parts can affect the game's potential for use in a learning context. I first outline the ideal, and then go on to explain how to assess a game that deviates from the ideal.

This model was originally developed while analyzing several strictly commercial videogames using another methodology I devised known as *instructional ethology* (Becker, 2007). In the process of producing extensive gameplay logs, it became apparent that one perspective for looking at videogames is from the point of view of what players are learning as part of the game experience. It turns out that all learning in and around a game can be classified into four broad categories.

The four categories of learning are as follows:

1. Things we CAN learn—as deliberately designed by those who created the game.
2. Things we MUST learn—this will almost always be a subset of the first category, and includes only those items that are necessary in order to win or get to the end.
3. External learning—This category includes learning that happens outside of the game: in fan sites, and other social venues. This category also includes "cheats."
4. Coincidental learning—other things we can learn. These are not necessarily designed into the game, although sometimes designers may hope that players choose to take these up.

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It is known that not all learning in a game is necessary to win, although some always is. It is also true that sometimes learning occurs that was never intended by the designers, while other times players learn things outside the game that help them inside the game (Becker, 2008c).

So it is that all learning in games can be classified as non-exclusive members of at least one of these sets. In the process of trying to show the relationships between these different sets, several visualizations of the interrelationships of these four sets were created, and the final picture ended up being somewhat bullet shaped. Thus, it was given the moniker “magic bullet” (Becker, 2008b).

When used in an educational context, this model includes an additional layer that is specific to educational contexts, so each of these categories becomes a subcategory of one of the following contexts:

- Operational component—How much is reasonable?
- Game controls and some mechanics.
- Necessary overhead.
- Educational component—How do you plan to use the game?
- This is the critical piece.
- Discretionary component—Can add value; BUT watch out for the decorative media trap.
- Anything that doesn’t fit into the other two categories (“fluff”).

Chapter Goals
- Explain how to approach gameplay in a structured, deliberate way.
- Understand the magic bullet model.
- Be able to use it to analyze a game.

Key Terms
These are the terms introduced in this chapter. Definitions for these terms can also be found in the glossary.

- End state
- Things we CAN learn
- Things we MUST learn
- External learning
- Coincidental learning
- Operational component
- Educational component
- Discretionary components
- Instructional ethology
- Short-form games
- Win state

5.1 Introduction

We already know that the way to the end of a game is through learning, but when looking for a game to use in the classroom, how can we know if the learning in a game is going to be the right kind for our purposes? Ideally, we should have a pretty good idea that a particular game is likely to be a good use of our and students' time *before* we start to build lesson plans around it.

Finding this out is not easy and most teachers are still largely on their own if they want to find a game to use as part of a lesson. There are a few places that list games for education, some even have reviews, and you will find a list of these at the end of the chapter; but, many do not provide much detail, and if you want to compare one game against another, it is even harder.

There are a number of ways of deciding whether or not a game will suit your purposes, and some are more popular among teachers than others. Word of mouth is one of the most important factors in the commercial success of a game, and what other teachers say about a game is similarly important when choosing a game for learning. According to the 2014 Games and Learning report on teachers using games in class, nearly half of teachers surveyed said that what other teachers say influences their own game selections, followed by whether or not the game includes assessment (43 %), and then their own experience (42 %). Other factors include research evidence, student opinions, the cost of the game, its rating, and reviews from a review site as shown in Fig. 5.1 (Takeuchi & Vaala, 2014). Clearly word of mouth is as important in games for learning as it is in entertainment games.

Suppose we have a game in mind for our class, but we can't find any lesson plans or teacher guides that suit our purposes to go along with it. In that case there are really only two ways to determine if that game is going to be suitable:

1. Research what others have said about the game, either
2. Informally, through word of mouth and various websites, or
3. Formally, through research studies
4. Play the game yourself

Let's look at the advantages and disadvantages of each.

5.1.1 Informal Research

Playing a game yourself is probably the best way to determine if the game you are considering is going to work in for you in your classroom, but who has the time? Teachers are asked to do more with less, and so many who would like to use games in the class can't because they simply don't have the time to assess a game properly. To complicate things further, unless you already have a community of people who can share their game experiences with you and/or help you find others who have experience with the specific game you are considering, the first research option may

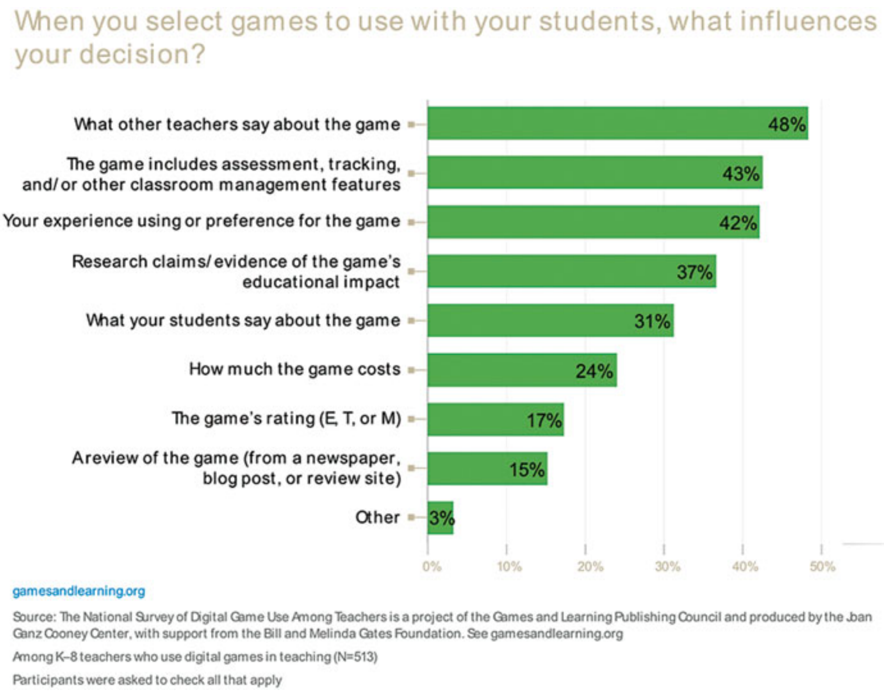


Fig. 5.1 Influences on game selection (Takeuchi & Vaala, 2014)

end up being just as time consuming as actually playing the game. We'll look at playing the game later.

Let's go back to option 1a: informal research. If you are lucky enough to have access to a community of people who can share game insights, then looking at informal research done by others is probably your best bet, but who those others are makes a difference. Informal research includes comments and reviews from family, friends, and colleagues, and while this sort of research is often easy to do, it is unfortunately not especially good when it comes to the kind of assessment we need. In the 1970s, the science fiction author and media critic Harlan Ellison made it quite clear that if someone were critiquing something, they should do so from first-hand experience.

> When I reviewed television, people said 'If you hate television so much, how come you've got a television set in your house?'. Stephen King even said 'You know, Harlan's got a big TV.'. Yes, that's right. I try to be courant. I try to know what it is I'm talking about. I am not like many people who give you an opinion based on some sort of idiot hearsay or some kind of gut feeling you cannot validate. When I give an opinion, I do my best to make sure it is based on information.
>
> (Ellison, 2007)

It is important to make sure that any reviews you get are based on first-hand experience rather than hearsay. But wait, there's more. Even though teachers tend to turn to their colleagues for opinions about a potential game, as they do for other things to great effect, their ideas about what makes a game good may not be supported in practice. There are reasons for this.

- It is possible for a game to be popular among teachers and yet unpopular among their students. If the students don't like the game, it is unlikely to be effective.
- We all bring our personal biases to informal assessments, and even those who do formal assessments must be ever vigilant to avoid tainting their studies and conclusion by personal preferences. Those who are not trained to be aware of bias in assessing technology may inadvertently skew their reviews in ways that preclude certain outcomes.
- Even if we could ensure unbiased, student-centered assessments, we already know that any single technology is not going to work equally well in all situations at all times.

So, although soliciting reviews informally from family, friends, and colleagues is worth doing, it should not be the only input you get before making a decision. Unfortunately, other forms of informal research such as reviews posted on blogs and game sites may not help much either. As we found out in the previous chapter (Commercial Off-the-Shelf Games (COTS)), the kinds of reviews that are usually done by voluntary players don't look at games from the perspective of formal learning and so are unlikely to help you determine if this game could work in your classroom. We can still get some useful information from people who have played the game though. Sometimes useful insights can be gathered by asking players specifically about their opinions regarding the game as a learning tool, but unless those people also have experience or training in teaching most people may not know what to look for.

5.1.2 Formal Research on Games

To find out whether a particular game is likely to be successful as a teaching tool, formal research is probably the most trustworthy though not always the most helpful. Research into the efficacy of various games in formal educational setting is growing rapidly. Unfortunately, it is still relatively difficult to find, and, once you've found it, it may still be difficult to read and digest. The problem is that most scholarly research focuses on describing phenomena; in other words, it tries to understand about games in the classroom, whereas teachers are more often interested in how to use games. Most teachers probably don't want to have to become game scholars in order to understand what the research is telling them, nor should they have to. Another problem with much of the game efficacy research is that even positive results are often not definitive, and just because something was successful in one classroom doesn't mean it will automatically be successful in another. As a general rule, the research literature is rarely organized to facilitate the use of the game as a tool, or "copying" approach. It is primarily focused on the measured results, which are important to be sure, but publications on game studies tend not to include lesson plans or any other resources that a teacher could use directly. It tells us about games in the classroom, not how to use them. Formal research can help us to figure out what kinds of games work better in particular kinds of circumstances, and they also help designers to better target their design efforts, but they don't help classroom teachers directly.

5.1.3 Playing Games

That brings us back to playing the game ourselves. As most dedicated gamers can probably tell you, it is possible to spend many hours playing a game, and although most people do indeed learn things while they are playing, they cannot always tell you what it was they learned. Haphazardly playing a game may not be enough to help you form a reasoned opinion about the potential of a game either, so it is important to approach playing a game in a deliberate way. You should have a set of properties that you are looking for when playing. Your goals during gameplay will be different from what they are when you are playing for entertainment. For example, rather than trying to win the game, which is the usual goal, your goal will be to assess the game's potential for your classroom by performing a kind of structured play. It can sometimes take a little while to get the hang of how to do this, so a great place to start is with *short-form games*. Short-form games are easier to tackle if you don't have much time or if you're new to assessing games as they usually only take a few minutes to play through. This brings us to the core of what this part of the book is about: analyzing games in a structured way that can help us determine whether or not a game will be of value to us in the classroom.

5.1.4 A Better Way

Our first analysis tool is a model that was designed to provide a simple visualization of how the learning in a game is balanced. It gives us a language we can use to talk about the design of a game. I originally developed this model while analyzing several strictly commercial videogames using another methodology I devised known as *instructional ethology* (Becker, 2008a). This work came out of doctoral work, and the goal of the original analysis was to try and discover how successfully commercial games taught players how to play (Becker, 2008b). To accomplish this, I played selected games and kept extensive gameplay logs. During that process, it became apparent that one way to look at videogames is from the point of view of what players are learning as part of the game experience, and it turned out that all learning in and around a game can be classified into four broad categories.

5.2 The Magic Bullet Model

We know that while there are many things players can learn in a game, only some of what they can learn is necessary in order to win that game. It is also true that sometimes learning occurs that was never intended by the designers, while other times players learn things outside of the game that actually help them inside the game. So, it is that all learning in games can be classified as belonging to at least one of these broad categories and comparing the extent of each one against the others can tell us something about that game. It can often be helpful to create visualizations for new concepts, and in the process of trying to show the relationships between these different categories, several visualizations of their interrelationships were created. The final picture ended up being somewhat bullet shaped. Thus, it earned the moniker "magic bullet" (see Fig. 5.2).

The four categories of learning can be described as follows:

- **Things we CAN learn (CL)**—As deliberately designed by those who created the game, and includes anything that players can learn from *within* the game. This can include learning from all domains (cognitive, psychomotor, and affective) and all categories (remembering, understanding, applying, analyzing, evaluating, creating (Anderson, Krathwohl, & Bloom, 2001)). Learning in this

Fig. 5.2 The magic bullet

category need not be related to any of the game's goals. For example, it is possible to learn how to create new items and levels in *Scribblenauts*, but the game can be won without ever doing that.

- **Things we MUST learn (ML)**—This will usually be a subset of the first category, and includes only those items that are necessary in order to win or get to the end. Since there is often more than one way to win a game these items must sometimes be qualified in the form of an if-then statement, such as the following: I we wish to pay off our mortgage in *Animal Crossing* I we MUST learn how to earn "bells." By contrast, planting fruit trees and selling the fruit is one way to accomplish this in the game, but it is not necessary as there are also other ways to earn "bells," so it falls under the CAN-Learn category for this goal. However, if the goal is to collect all possible forms of fruit, then "planting fruit trees" falls under the MUST Learn category.
- **External learning (EL)**—This category includes learning that happens outside of the game: in fan sites, and other social venues. This category also includes "cheats." One could argue whether or not this should be seen as a category distinct from things we CAN learn. Cheats were originally designed into the game for testing purposes, and are often left in the game once it ships. Thus, they are deliberate design elements on the part of the designers, but are not really considered part of the normal gameplay. Note that some game designers may consciously put the cheats into play by assuming that people will use them and designing accordingly but they are rarely, if ever, *required* to win, so they are almost never part of what we MUST learn. However, for many people, a game like the original *Myst* cannot be won without turning to game guides that include spoilers, so for them the Must-Learn category would include some external learning.
- **Coincidental learning (CoL)**—This includes anything else we learn that is triggered by the game. These things are not necessarily designed into the game, although sometimes designers may hope that players choose to take them up. For example, *Tekken* is a martial arts fighting game featuring a form of fighting called *capoeira*, which is a Brazilian form started by slaves that combines dance, aerobics, and music with kicking. As a direct result of playing this game, players may research and learn about capoeira, although it won't help them win in the game.

Some categories will often overlap, such as the Can-Learn (CL) and Must-Learn (ML) categories, and others never will, such as the Can-Learn and external learning categories, or the Must-Learn and CoL categories. Since Can Learn (CL) consists of things we can learn INside the game and external learning (EL) consists of things we can learn OUTside the game, they are mutually exclusive. Similarly, since Must Learn (ML) is necessary learning and CoL does not help players in the game these are also mutually exclusive. They can never overlap.

By attempting to visualize the relative amounts of each of the four kinds of learning one can create a picture of the game from a learning perspective. One can quickly get a sense for how the various learning opportunities are balanced against each other. In most cases it is not going to be possible to create an exhaustive list of all the possible learning in a game, but that's OK because we don't need to do that in order to use this model. In fact, because this is a highly subjective model, two different people could end up creating two different magic bullet "maps" for the very same game. That's OK because the models can then be used as focal points for a conversation about the game, which can be very valuable.

Let's take a closer look at each one of the four categories.

5.2.1 Things We CAN Learn (CL)

We make a distinction between learning and education, and while many games are not educational, there are always things we CAN learn from every game—even the bad ones. Included in the Can-Learn category are all the things that have been deliberately designed by the creators of the game. Some of these will help the player progress through the game, but not all. For example, many games allow players to customize their characters, but this rarely helps the players win. Sometimes this is as simple as being able to choose from among a small number of predetermined avatars, but other times it can become quite complex. In *Animal Crossing (AC)* clothing and other accessories for your character can be collected. Some items such as special hats or outfits can only be collected at certain times of the year. Players can learn the best ways to find these items, which not only includes being in the right place at the right time, but can also include connecting other players using Nintendo's "StreetPass," which is a way for people who have a Nintendo DS to exchange certain kinds of information with other players through a short-range wireless connection. AC players who have exchanged information via StreetPass gain the ability to visit the houses of others in a section of the game called the "Happy Home Showcase." This, in turn, gives them the ability to see and purchase some of the items they own. For many, this is a fun part of the game, but it does not really help players win anything, other than perhaps being able to complete collections of items.

The CL category includes all things that can be learned from within the game itself. In most games, this is the biggest category.

5.2.2 Things We MUST Learn (ML)

Every game should have some things that players must learn if they are to succeed in it. If they don't then winning is merely a random event. The ML category includes all those things that players must learn in order to get to the end, although there are many games that have a variety of sub-goals, not all of which are necessary. We often associate the word "win" with success in a game, but winning is not always necessary, especially when talking about learning. There are even some games that can't actually be won, or where the *win state* is an unhappy one. *Tetris* is an example of a game that can't actually be won. No matter how fast one becomes at arranging and stacking those shapes, there will always be more to come. The game will always end with the blocks reaching the top of the playing field. Another example of a game that can't be won is *Ayiti: The Cost of Life*. This is a game intended to help players understand the difficult choices faced by poor people living in developing countries, and although it is possible to get to the end of the game, there is no happy ending. In both cases there are things players must learn in order to get to the end of the game although the *end state* of each game would not be called a win.

As the magic bullet is a subjective model, the idea here is to represent the overall impression of the game using a shape of a size and placement that captures the learning you would consider to be required in relation to that which is not required. IF there is very little that must be learned compared to what can be learned, then the Must-Learn circle will be small. There are even some games where players need to go outside of the game and learn things in order to succeed, in which case the ML circle will extend beyond the CL region.

5.2.3 External Learning (EL)

Learning that happens outside the game is external, and includes all sources of help that people may use in order to progress through the game. External learning is usually not essential, but it does help the player succeed. The amount of external learning associated with a game can vary widely, of course, and it is also subject to considerable player variability. A player that turns to a *walk-through* without ever trying to play through alone may learn little from a particular game, even though others may learn a great deal. Unless the game is quite simplistic however, a walk-through will rarely be able to show all of the possible paths through a game. While few people use walk-throughs to help them get through a whole game, some do use them to help them decide whether or not to buy a game. They will also use portions of a walk-through when they are stuck in a game. This last use of walk-throughs is counted in the category of external learning, and when it comes to G4L, this sort of help can be quite valuable.

5.2.4 Coincidental Learning

CoL is unplanned learning that can happen in or around a game. It is rarely something that has been deliberately designed into the gameplay, but it may be something that the game designers hope that people will learn. The kind of learning that comes from this category has the potential to be quite significant. For example, someone may play a racing game and decide that they want to pursue a career in racing as a result, but it is more common for this kind of learning to be what in past generations might have been labeled “enrichment.” CoL is not something that helps players get through the game, but it may be something that is useful or interesting outside the context of the game. As a result of playing *The Blood Typing Game*, a simple game intended to teach people about blood types, the player may be inspired to find out what their own blood type is, or even to find out more about blood donations.

This category would also include learning that comes out of emergent behaviors and uses of the game. This final category is the one that often concerns formal educators to a certain extent. Some educators have a degree of apprehension about letting their students interact with something they cannot really control, and they see games that prompt CoL as being something they can’t control. Of course, the reality is that we never really have control over the learners in our classes at all, although we can and should have influence.

5.2.5 Variations on a Theme

It’s now time to take our model and use it as a lens through which to look at a few games.

The fine details—in other words the exact sizes of each of the categories visualized—really don’t matter. The point is to visualize the learning to give us a picture we can use as a talking point.

Note also that balancing the learning one way or another cannot guarantee that a game will be good, nor is it a clear indication that the game is bad. The balance of learning in a game must always be taken in context. To underline that point each figure we consider includes examples of bad games as well as good ones.

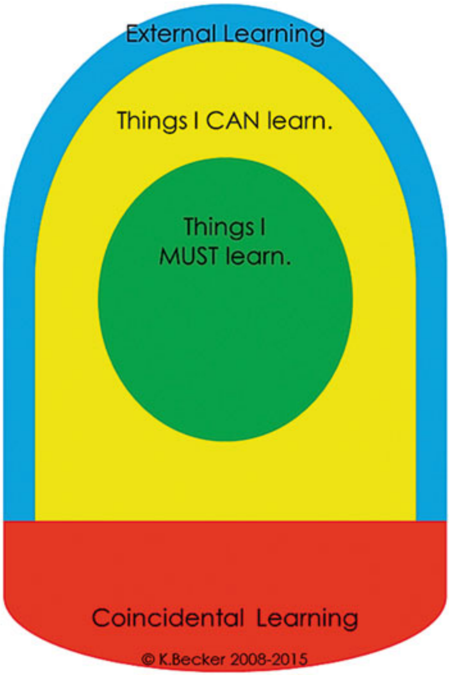
5.2.5.1 Equal Balance

Can Learn > Must Learn 1

A good place to start is with the mapping that shows the typical balance of most popular games. This first set of mappings (Figs. 5.3, 5.4, 5.5, and 5.6) all share the property that the Must-Learn elements make up less than half of what can be learned. The first one, shown in Fig. 5.3, shows a game where all parts are well balanced.

A key aspect of many successful games is that there is little or nothing that must be learned that cannot be learned from the game. In other words, the Must-Learn circle is completely contained within the Can-Learn bullet. In addition, the amount that must be learned is less than half of what can be learned, but still sizable. Neither external learning nor CoL are necessary in order to get through the game, but both are possible. This is a game that can be played alone, but that also allows for learning outside of game from the community at large.

Fig. 5.3 Good balance 1



Examples of games with this sort of balance include most of the "tycoon" games such as *Zoo Tycoon* and *Railroad Tycoon*. These are resource management games where the player builds either a zoo or a railroad and must make various choices while doing so, like what to charge people and where to place assets. There are a great many choices for players, only some of which help them succeed. For example, there are several different types of fences, plants, and other items in *Zoo Tycoon* and they have different purposes. To keep your animals from escaping, you must use the right kinds of fences for example. This is something you *must* learn. Each animal also has some items that can be included or excluded from their habitats without benefit or detriment. That means you can choose whichever ones of those you like the best. This is something you *can* learn.

Can Learn > Must Learn 2

It is not always necessary for all of the Must-Learn category to be entirely contained within the Can-Learn field. It is possible for some of the required learning to be external to the game as shown in Fig. 5.4. This mapping is largely the same as the previous one, but some of what players must learn in order to get through the game comes from outside of the game itself; in other words, external learning is necessary. It could be that it comes from a player community, but it also could be something that requires other research.

Fig. 5.4 Good balance 2

A classic example of this kind of mapping is the 1980s hit *Where in the World is Carmen Sandiego?* This was a game where players had to use their knowledge of geography and social studies to retrieve an artifact that had been stolen by Carmen Sandiego. Kids playing this game sometimes complained that they didn't know enough about geography to win.

This sort of mapping can be useful in an educational game, but it must be designed with the knowledge that players will need outside help in order to get through. While an entertainment game may be able to get away with leaving the player to his or her own devices, a game for learning must provide a way for players to access the necessary support. This can come in the form of teacher support, but it must be present.

Can Learn > Must Learn 3

Figure 5.5 is a variation on Fig. 5.3, but is lacking the CoL. It could be argued that CoL is always possible in a game, but there are examples where one would be hard-pressed to identify what that might CoL be. This mapping is included to show that CoL need not always be a requirement in a good game. Some puzzle games fall into this category, especially those where winning can sometimes happen at random such as with many of the *Bejeweled®* style of games where players attempt to clear

Fig. 5.5 Good balance 3

a board by connecting groups of three or more identical items. There simply isn't that much to the game that would prompt coincidental learning. The *Bejeweled*® style of games are also unwinnable games where one's score is a measure of success rather than actually completing the game. It is possible to become very skilled at these games by learning new strategies, either through practice or externally, but much of it is not needed in order to make some progress.

Can Learn>Must Learn 4

The next mapping shown in Fig. 5.6 still has the Must-Learn field covering less than half the area of the Can-Learn field, and it still has a reasonable amount of possible CoL. However, these games have a larger external component that includes things necessary for success in the game. These sorts of games are especially useful in a game for learning, as they require learning outside of game, but if they are to be successful, it is crucial that there be sufficient external support to facilitate that external learning.

The *Civilization Series* of games fit in well here. They are known to have a substantial learning curve, and there are a great many things players can learn that do not directly impact their ability to win, but most people cannot become really proficient players without outside help.

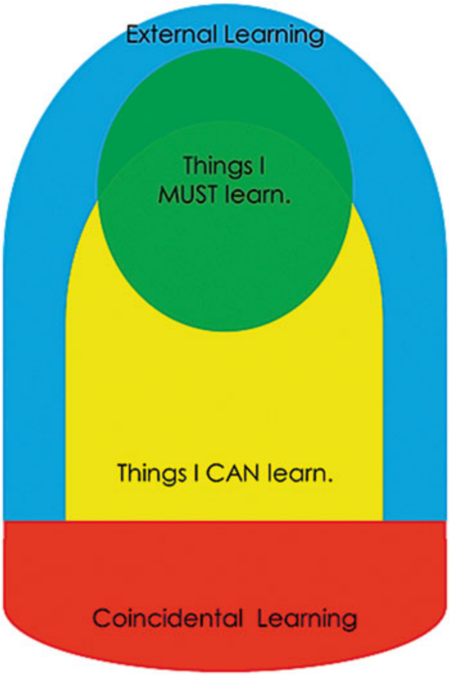


Fig. 5.6 Good balance 4

5.2.5.2 Must ≈≈ Can

MUST Learn ≈ CAN Learn

The next set of mappings (Figs. 5.7, 5.8, 5.9, and 5.10) are those where the Must-Learn is a considerable component of what players Can-Learn in the game. Although there is less optional learning in these kinds of games compared to the previous category, they can still be good games. Many educational games will fit into this set rather than the previous set. Part of the reason for this is purely practical. We rarely have the luxury of time for casual exploration in formal learning. Even though exploration and experimentation are valuable, we most often want it to be directed towards predefined learning goals. Another reason has to do with the cost of production. Budgets for educational games are typically a lot smaller than for entertainment games, so there is less money for the design and development of unneeded extras. Because a greater component of the game includes things players must learn, they can be challenging for some and frustrating for others. Some of these games require players to repeat plays and levels many times. Both external and coincidental learning are possible, but not necessary. One thing that is important in this scenario is that the more one MUST learn of the total set, the fewer choices players will ultimately have.

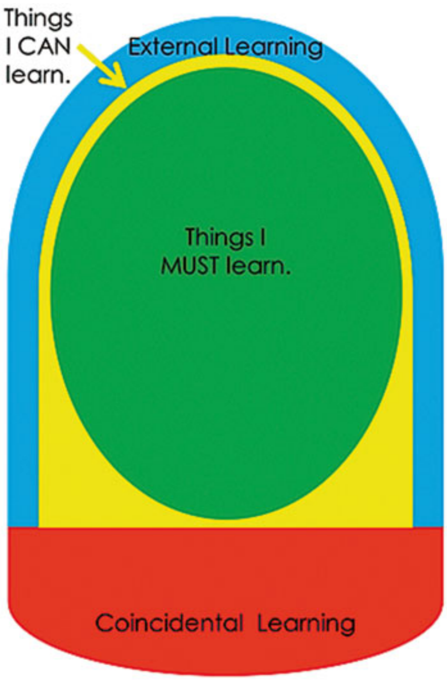


Fig. 5.7 Must ≈≈ Can 1

MUST Learn ≈ CAN Learn 1

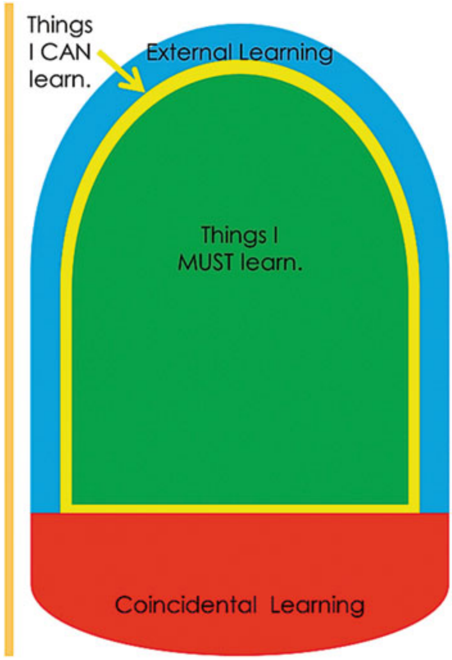
The first variant shown in Fig. 5.7 has much the same balance as Fig. 5.3, but the proportion of CL to ML is roughly equal. Although *Phoenix Wright* is a game *on rails*, it still manages to be entertaining. One wouldn't normally think that a game about lawyers would be fun, but this one requires the player to gather evidence and uncover clues and then present them in court in order to win their client's case. It is not possible to skip any parts and almost all interactive parts are in some way connected to the goal. However, the cases are interesting and each one offers a new kind of clue.

You're in Charge features a young child of indeterminate age who is left at home alone. The player's challenge is to solve various problems in the given time. Players earn points for acting responsibly and lose points when they don't. Although the premise is sound, the instructions involve a lot of reading, there is little room for exploration, and every interaction is connected with the goal. There is nothing the player can do just for fun.

MUST Learn ≈ CAN Learn 2

The second variant (Fig. 5.8) in this set describes a game where there is virtually nothing one can learn from the game that isn't needed in order to get to the end. This is a common approach in many educational games. Many drill and practice games

Fig. 5.8 Must ≈≈ Can 2



fit here, and in some cases they can end up being little more than interactive worksheets. Now, there's nothing wrong with an interactive worksheet *per se*, but it can be misleading to present it as a game. Given that the goal of a worksheet or drill and practice is precisely to provide the learner with more opportunities to practice some skill or procedure, then anything that results in more time on task can be considered successful. There are numerous examples of interactive worksheets or drill and practice games that are quite enjoyable.

Chicktionary is a word scramble game where players are given seven letters and asked to make as many words as possible using just those letters. What makes this game enjoyable is that each letter is represented by a hen and every time the player clicks on the letter, the hen lays an egg that also bears the letter. She also clucks. Should the player change his or her mind, the "reset" function causes all the eggs laid so far in this round to go back up into the chickens—much to their surprise. The screen includes a board that indicates exactly how many 3-, 4-, 5-, 6-, and 7-letter words can be made from these letters so the player always knows where they stand. This is essentially an interactive worksheet, but it is one that is entertaining and is likely to achieve the goal of having players spend more time on task.

Privacy Playground is a game designed to teach 8–10-year-olds about Internet safety. It features a number of characters who are collectively called the "Three Cyberpigs" talking about and demonstrating various scenarios. The use of pigs as the characters may be somewhat ill advised, but they are relatively appealing and the scenarios address issues that are genuinely important. Unfortunately, the "game" part of this application consists of an alien character who acts as a narrator asking quiz-type questions that require a simple yes or no answer. There really is nowhere for the

Fig. 5.9 Must≈≈Can 3

player to explore—each "level" consists of an animation that presents a scenario followed by a series of yes/no questions—hardly a game, and even if we consider it an interactive worksheet, yes/no questions don't normally foster reflection. The game becomes tedious very quickly and the benefit of the game wrapper is wasted. This is an example of an interactive worksheet that does not deliver on its goal.

Turning to actual games, many *side-scroller platform* games are ones where players must essentially learn all there is to learn in the game in order to get to the end. Depending on the subject of the game, there may or may not be opportunities for CoL. Perhaps one of the best known examples of a successful platform game is the *Super Marion Bros.* franchise. This game is very much like an old-fashioned obstacle race, where players must overcome various challenges while racing to a finish line. *MathBlaster* is also a platformer, but it is an example of a game where this mapping fails. This game is highly rated by educators, but often identified as a poor example by game designers. Both games promote learning by trial and error and, when looked at through that lens, it is easy to see why *Mario* succeeds where *MathBlaster* fails. Specifically, a "good" game that employs trail and error must also provide sufficient choice for the player to backtrack or repeat sections as desired. Ideally the user uses these strategies to improve his or her score, or to simply have some options about which order to progress through the levels. A "good" game like this must also provide thorough and constant feedback on the player's status as well as consistent and immediate action feedback. *MathBlaster* does neither.

Fig. 5.10 Must ≈ Can 4

MUST Learn ≈ CAN Learn 3

A game where there is little to learn that isn't part of the goal and where there is little to no CoL is depicted with the mapping shown in Fig. 5.9. Many games that are referred to as edutainment fit in here. These are typically games that are primarily focused on the stated learning objectives and so they don't leave much room for exploration. It is a self-contained game in that there is nothing the player must learn that isn't part of the game, but the general lack of CoL opportunities implies that this is either a single-purpose game or an impoverished one. Just as in the previous examples, the more one MUST learn of the total set, the fewer choices players may ultimately have.

This does not necessarily mean that the game is a bad one, but the design choices must be made very carefully.

Katamari Damacy is a game with a very distinct objective: to repopulate the sky with stars. This is to be accomplished by going to Earth and rolling up various man-made and other items using a katamari. It has a tutorial at the start that cannot be avoided. This game begins with a brief backstory, as do many games, which sets the premise for the gameplay that follows. The story is expanded a little later in the game and also provides the support for segues between levels. The basic controls for each level involve only the left and right analog sticks, which are used to roll the katamari. At the start of the game players are led through a tutorial mode, where each distinct move sequence must be demonstrated before the player is allowed to progress. Given that the controls for this game are very simple, the bulk of what needs to be learned has to do with strategy.

By way of counter example, *You Make Me Sick*, a game for middle school designed to teach players about bacteria and viruses, is also a game where much of what we can learn is also what we must learn, at least as far as gameplay is concerned. There is a great deal of information that is presented in pop-ups. If we don't learn what we need to then the avatar ends up wandering aimlessly about his apartment. The controls are not obvious enough, so player can easily feel stuck. It takes a long time to get to the point of the game, and what happens within the game often appears to be random.

MUST Learn ≈ CAN Learn 4

The final variant of this set (Fig. 5.10) depicts a game that has insufficient internal scaffolding. It is one where players will need considerable outside help and/or resources to get the intended message. Since the game design does not provide scaffolding, it must be provided in some way from outside of the game. A game like this could be an excellent game provided that players are not left to try and figure things out completely on their own. There must be a sound lesson design around the game.

It is worth mentioning here that the mapping of a game is partially a function of the players. For example, a generally well-balanced game intended for middle schoolers might look like Fig. 5.10 if played by preteens. An example of a G4L that would fit this category is a game called *Stalin's Dilemma*. This is an older spreadsheet game created by Ed Bever in 2000. Stalin's Dilemma is a game developed to help students understand soviet industrialization through economic planning. The game is played by setting up resources and making various decisions in such a way as to ensure success. Players have three turns in which to accomplish their goal. Each turn simulates a 5-year span of time. This game has been deliberately designed so that players must take advantage of external learning if they are to succeed.

5.2.5.3 Must > Can

MUST Learn > CAN Learn

When a game is designed so there is little or nothing to be learned in the game that isn't necessary and also so that players must take advantage of external learning to succeed, we have the kinds of games depicted in the mappings of Figs. 5.11 and 5.12. These sorts of games tend to worry traditional educators, because players need outside help and resources to get into the game or to progress. On the other hand, these games CAN still be good, but this kind of design has serious implications for audience and support requirements. It is very risky, but can also be useful in serious games. As shown in Fig. 5.6, games do not always need to be self-contained.

MUST Learn > CAN Learn 1

In Fig. 5.11, the player cannot learn all he or she needs to in order to get through without turning to external help of some sort, and there is very little to learn in the game that is not necessary.

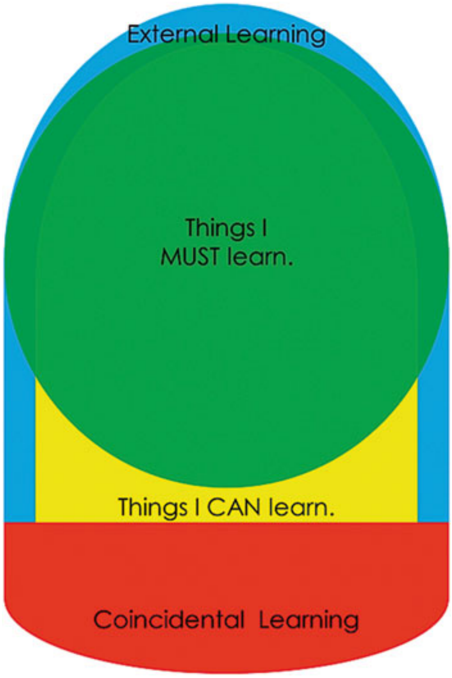
While there are quite a few good games to be found at Nobelprize.org, there are also a few that could do with improvement. One example of these is *DNA: The Double Helix*. This is effectively a twitch game where players are presented with the DNA sequence of some organism and then asked to replicate the strands within a specified period of time. On the surface, this sounds like it could be a fun little game but players who fail to memorize the standard base pairs are left to guess through an entire round. There is no way to pause, or to review any of the text screens displayed before the game begins. If a player gets behind in their matching of base pairs, there is also no way to catch up as the two sequences continue to scroll by and once a portion has scrolled past the screen there is no way to access it. At the end of the round players are asked to guess what organism the strand belonged to and penalized when they are wrong. There are nine organisms to choose from and no discernible way to deduce which one it may be. In other words, the choice appears completely random. Getting penalized for getting the answer to a question wrong when the player has no way of figuring it out seems rather counter-productive as far as learning goes.

MUST Learn > CAN Learn 2

Figure 5.12 describes a game that has no CoL, along with an imbalance between the Can-Learn and Must-Learn components. In addition, there are things the player must learn that cannot be learned from inside the game. This can make for a very frustrating game. Without sufficient external support this effectively becomes an unwinnable game, but given that there really isn't much opportunity for exploration or experimentation, it can also be tedious.

School Daze Crazy Maze is a game that sounds like a good idea, though it's not clear what the learning objectives are. Players are presented with a map of a hypothetical school and told that they need to find their way to class on time. They must navigate a maze while avoiding various obstacles. Unfortunately, players can't see the entire maze at once, so they cannot plan a path but instead must search for one. If they guess wrong, they will lose valuable time backtracking. If this game used the map of the player's actual school, it might be more entertaining—and the players might actually learn something. As it is they cannot learn enough from the game as it is presented to be able to create any real strategy aside from moving as fast as possible.

Fig. 5.11 Must > Can 1



5.2.5.4 Must ≪ Can

MUST Learn ≪ CAN Learn

There are several possible reasons for a situation where the amount that players must learn is considerably small than what they can learn. One possibility is that the game is a vast one with large spaces to explore and many things the player can choose to do. An example of this type of game is the *Elder Scrolls* series, especially the two more recent releases, *Oblivion* and *Skyrim*. While these are both very popular games, this format doesn't normally fit well into a formal educational curriculum, unless it is being used as literature. If it is a shorter game, then one where there is little that must be learned can come off as lacking direction. This game appears to be aimless which makes it more of a toy than a game. Alternately, it could also describe a straight simulation. If there is not enough we must learn in order to win, there may be insufficient challenge if there is nothing else to hold the player's interest.

An example of a game with the kind of balance shown in Fig. 5.13 is a game for the Nintendo DS called *Electroplankton*. This isn't really a game at all but rather a sound application that looks like a game. Each level or scene has various items that make different kinds of sounds that can be controlled and altered by interacting with them in various ways. *Fission Impossible*, on the other hand, is a game. It claims to teach players about fission by being inside a nuclear bomb. Players are supposed to navigate through a nuclear fuel rod playing the role of a neutron hunting for

Fig. 5.12 Must > Can 2

Uranium-235 to create nuclear fission. They are to avoid Uranium-238 and flying too close to the edge. This is a game in the style that is often called *twitch games* where winning has more to do with speed than almost anything else, and this one is exceedingly difficult to win. It is also possible to figure out what is needed to win the game without ever realizing what the objects on the screen are supposed to represent.

MUST Learn ≪ CAN Learn 2

When there aren't many things that the player must learn to get through the game, and there are few external learning opportunities as well as little in the way of CoL, we sometimes end up with a game that does not hold the player's interest.

Fast Car claims to be a game for young people that promotes healthy behavior while providing them with information about HIV prevention. Players drive along various tracks where they will have an opportunity to see various UNESCO World Heritage Sites. At various points along the way they are asked multiple-choice questions about HIV and AIDS. While players could indeed learn by reading the pop-ups and then answering the questions correctly, they really don't need to, and can make their way through the game by guessing without really learning anything. As in most games, there is always the chance that players will be inspired by the game to learn things beyond the game itself, but the way in which the information is presented here is unlikely to provide that inspiration (Fig. 5.14).

Fig. 5.13 Must ≪ Can 1

MUST Learn ≪ CAN Learn 3

The final mapping in this set depicts a game that probably isn't a game at all. Without required learning there is really no direction and so play in this "game" is likely to be aimless. Even simulations have a certain amount that must be learned, even if it is just how to operate the game. Without any required learning at all, this object is a *toy* (Fig. 5.15).

5.2.5.5 Thin Games

Thin Game

While there are many good games that are short-form games, in other words, ones that don't take long to play through, there are some that are simply thin without also being short. Often though the Can-Learn component needn't be much bigger than Must-Learn component in a short-form game. Ideally, an educational game of this sort would be intended to teach one thing well, rather than trying to do everything just a little.

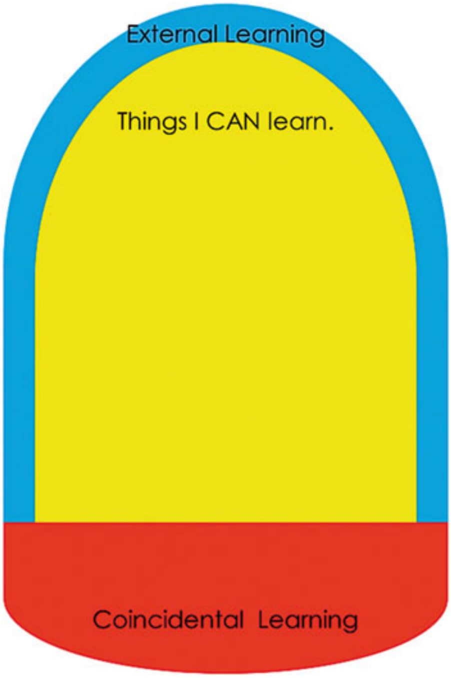
Fig. 5.14 Must ≪ Can 2

Thin Game 1

The first scenario is that of a well-balanced short-form game. The *Blood Typing Game* is an example of an educational game that fits this category. All four kinds of learning are possible, but none are extensive. The primary goal of the game is to teach people about the standard human blood types. The player is the health worker who needs to choose the right blood to give a patient. If you give the patient the wrong blood type, they get a very surprised look on their face and express alarm. This is a game where players can learn both when they get things right and when they get things wrong.

By contrast, *The Food Chain Game* (by Sheppard Software) does not allow players to ask any "what if" questions. Players are to place the objects in the correct order to make a food chain, but if they try to place an item in the wrong position, that item simply drops back to the bottom of the screen. It only stays where it's put when placed correctly. Although it might be possible to inspire players to learn more about food chains or even the objects they've been asked to place, the lack of entertainment and choice in this game makes that unlikely (Fig. 5.16).

Fig. 5.15 Must ≪ Can 3



Thin Game 2

A game where there is little to learn outside the game and where almost everything I can learn are things I must learn in order to win is likely to be bad if a level or round is too long. If everything I can learn in the game is essential to winning, there is no room for exploration and if this happens in a long game then it can feel like the player is simply following along and has no real control. However, it could be good as a drill game or as a puzzle. This mapping as shown in Fig. 5.17 is much like Fig. 5.12, but is a much smaller (and shorter) game.

Add'Em Up is just such a good drill game. It is a novel variation on addition drill that asks players to clear a square grid containing single-digit numbers. On one side of the screen is a scrolling list of numbers. For each of these numbers, players are to select a set of adjacent squares whose digit sum adds up to that number. The greater the number of digits you can combine to achieve that sum, the faster you clear the board. However it is possible that players may be inspired to find or even build their own math games as a result of this game, which would constitute CoL. However, this sort of learning is possible with any game and so would not normally be counted.

5.3 Magic Bullet for Education

When looking at games from a learning perspective it becomes clear that the balance of learning in a game can vary a great deal. It turns out that simply dividing learning into four categories is insufficient. A simple mapping of the learning in a

Fig. 5.16 Thin game 1

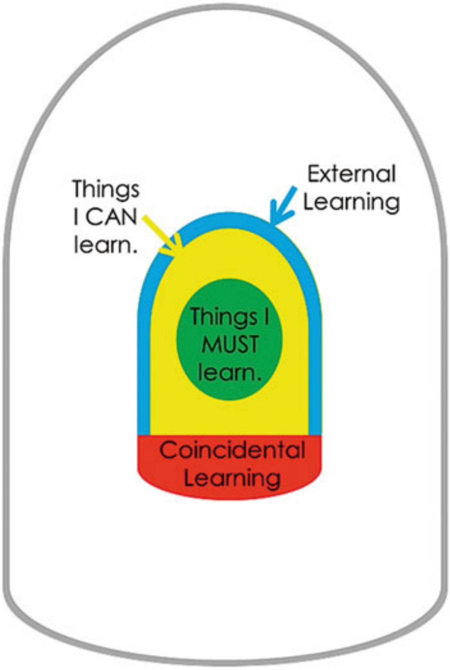
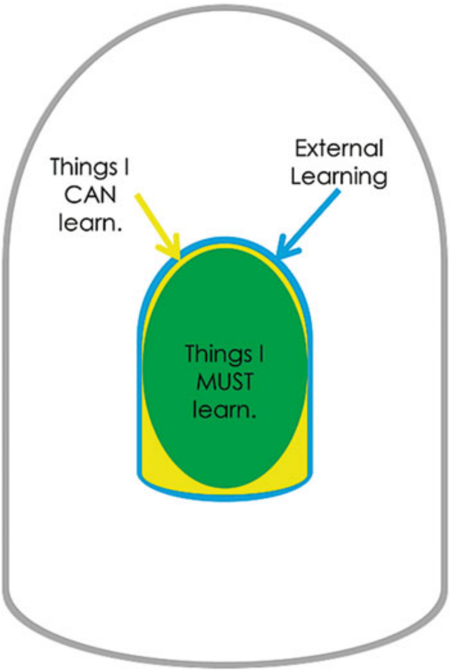


Fig. 5.17 Thin game 2



game can be very useful for focusing one's thinking when trying to assess the potential in a game and it has been used as a tool for considering a variety of entertainment game designs. When our goal is using games for learning, the picture becomes clearer if we add one more layer. This additional layer is specific to educational contexts, so each of the original four categories becomes a subcategory of one of the following contexts:

1. Operational component—How much is reasonable?
   Game controls and some mechanics
   Necessary overhead
2. Educational component—How do you plan to use the game?
   This is the critical piece
3. Discretionary component—Can add value; BUT watch out for the decorative media trap.
   Anything that doesn't fit into the other two categories ("fluff").

Each of these layers can also be described using the same mappings of the four categories, as each one will also have things the players *can learn as* well as things they *must* learn. Some will also have an external learning component, but most games will not have operational learning that would be described as coincidental. While it might be possible to find a game where something the player learns coincidentally affects the operation of the game without actually helping the player, it is probably quite uncommon.

Let's take a brief look at what each of the three new layers would include.

5.3.1 Operational Learning

The *operational* component includes the things that players need to learn in order to be able to play—that is operate—the game. This includes learning how to control the action in the game, whether that be by controlling an avatar or by manipulating various items. It also includes learning how to access status information and what the status screens tell us (often called *Heads Up Display* or *H.U.D.*). Here there can be an advantage to using a game from a familiar genre. For example, we can use a *Jeopardy!*™-style game and assume that once players know how that kind of game works we could use a different game of the same style and know that players won't need to spend time learning how to play. In that way the operational learning is minimized and we can spend more of our time on the educational parts. It might seem that this would make a game like *Jeopardy!*™ ideal, since there isn't much in the way of operational learning required. Unfortunately, with something like *Jeopardy!*™, there really isn't much in the way of game either. It is basically an interactive worksheet, so it has more to do with quizzing players than it does with learning, but the fact remains that learning to "play" will take very little time once the first activity of this sort has been learned.

There is likely to be an unavoidable operational component to any game, but this is also true of any technology—even textbooks. In a game that doesn't take very long to play a round, the operational learning may be very small, like it is in a game like *Angry Birds*. There really is only one action sequence the player can take—load a bird, aim, and shoot. This takes very little time to learn. The rest of the time in the game is spent figuring out the necessary physics in order to aim and shoot most effectively. In a complex game the operational component may be substantial. The *Civilization* series, for example, may take days or even weeks before they are familiar enough with the game to begin to reap the educational benefits. As with the four main categories, the relative proportion of the game taken up with operational learning will tell us something about how this game might be used, but it can't usually predict whether or not the game will be good.

5.3.2 Educational Learning

The next layer is the educational layer. It is the critical piece for us, and the piece we primarily considered in the examples from the first part of this chapter. The educational layer includes all the parts associated with the formal learning objectives. While it would be nice to believe that all of the educational objectives should fall within the Must-Learn category, if we are truthful we will recognize that the same four categories exist here too. This approach forces us to rank our learning objectives into those which are essential (Must Learn) and those which are desirable (Can Learn). The external learning category covers those objectives not addressed from within the game, and the coincidental category is for those things we would like our students to accomplish but can't really insist on.

5.3.3 Discretionary Learning

The third layer is for those things that are neither operational nor educational. This is called discretionary. It should only be considered after the first two have been reviewed. In education we have a tendency to think of this category as "fluff." It can take up valuable time and many educators struggle to justify this layer. If we have done a thorough job of considering the balance of the other two layers, then we are in a good position to assess this aspect as well. Humor fits in here, as does trivia. Anything that doesn't help players learn how to play the game or meet the educational objectives is part of this category. It should normally play a subordinate role to the other two, but it would be a mistake to assume that it can be completely omitted. Without this layer, the rest risks being seen as boring and therefore unmotivating. In the end we must remember that we are talking about games. A game that consists only of operational and essential educational components is probably not going to feel much like a game. A game that deals with a very serious topic may be far too grim if it does not include something lighter as counterbalance.

5.4 Summary

In this chapter we looked at quite the magic bullet model for classifying learning in a game. It can be used with any kind of game, from those made purely for entertainment to those made purely for learning. It can even be used on a prototype of a game that hasn't been built yet.

If you are familiar with some of the games that have been used as examples, you might have noticed that you disagree with some of the assessments. That's actually a good thing. As was said at the start, the magic bullet model is not an objective tool. In fact, it is highly subjective, and as a result different people are likely to classify the learning in a game differently and they may well place a given game in a different category from the one you chose. There really aren't any right or wrong answers here. It is important to reflect on your choices and to explain why you placed a game in a particular category. If two people examine the same game and come up with the same mapping, then they can compare notes and see if they placed the game the way they did for the same reasons. If they chose different mappings, then the discussion will follow a different path. Either way the mappings provide a structure around which to have a discussion about the learning in the game, and that is the main purpose of the magic bullet.

Resources

The resources listed here are places that provide lists of games that have potential for use in education along with reviews and information on where they might be used.

Backpack Games http://www.backpackgames.com/

"Back Pack Games provides high quality games from around the web which are categorized according to educational standards by grade level, and many are aligned with Common Core Standards. Our games help students practice Math, Science, Problem Solving, and Vocabulary Skills. Play learning games online with your students for free."

Common Sense Media http://www.commonsensemedia.org/

"We'll give you the scoop on the latest entertainment and tech so YOU can decide what's right for YOUR kid. As an independent, nonpartisan, nonprofit organization, we're here for you."

edWeb's Collaborative Games for Learning Database https://docs.google.com/spreadsheet/ccc?key=0AsuaqFwUI1WfdFRaSUxhWjhEZlBtSk1TMEozZWFKZHc&hl=en_US&usp=gmail#gid=0

Extra Credits EDU https://docs.google.com/spreadsheet/ccc?key=0AsuaqFwUI1WfdFRaSUxhWjhEZlBtSk1TMEozZWFKZHc&hl=en_US&usp=gmail#gid=0

"Games suitable for aiding and enhancing learning in various educational settings. All recommendations are categorized by suggested subjects, minimum play length, and recommended teacher gaming experience."

Games and Impact.org: http://gamesandimpact.org/games/

"This area of our site features the Center for Games and Impact's collection of impactful games. We've provided resources to help you understand a game's impact as we understand it (for example, try downloading a game's Impact Guide to complement your play experience with one of the games listed here)."

Games for Change Database http://www.gamesforchange.org/learn/game-databases/

A list of resources to help people find social impact, learning, and health and science-related games.

Gamifi-ED http://gamifi-ed.wikispaces.com/

Student- and teacher-reviewed game listings.

Graphite https://www.graphite.org/

"Graphite™ is a free service from non-profit Common Sense Education designed to help preK-12 educators discover, use, and share the best apps, games, websites, and digital curricula for their students by providing unbiased, rigorous ratings and practical insights from our active community of teachers."

Learning Works for Kids http://learningworksforkids.com/playbooks/

"Our focus is on evaluating games for their usefulness as teaching tools for the development of executive functioning and academic skills, so that the most important part of the site for parents and educators is on the "play together and make it work" tabs."

Playforce.org http://beta.playforce.org/ (Institute of Play http://www.instituteofplay.org/)

"A community built for and by players, parents, and educators to discover and share learning experiences in games."

Playful Learning http://playfullearning.com/

"The Playful Learning platform aims to ignite the use of quality games for learning in the classroom. As part of this growing movement, we're creating an online portal where you can discover games and key information on how to use them. The platform presents both educational and commercial games with easily navigable searches and filters."

Teach with Portals http://www.teachwithportals.com/

"Includes a wiki and forum for discussion and sharing of resources as well as a separate space where teachers can submit lesson plans. All of the content is publicly available, allowing teachers to access the resources at their convenience."

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Chapter 6
Evaluating Games

> *"The invention of new methods that are adequate to the new ways in which problems are posed requires far more than a simple modification of previously accepted methods."*
>
> *Vygotsky*

At-A-Glance

This chapter takes readers through a step-by-step process for analyzing games that will highlight the key issues associated with the use of games in the classroom.

Videogames are interactive by nature. People proceed in games by doing things, and this experiential quality lies at the very core of game design. Without interaction, it isn't *a game*. Videogames are popular precisely because of the experience—games designed for learning can do no less. However, to be feasible for use in formal educational settings, they must do more. While we are making progress studying games in classrooms, there are few structured approaches to analyzing games that do not include classroom testing.

This chapter outlines the four pillars of game-based learning and provides examples of how they can be used to perform a *structured analysis* of both COTS and serious games to assess whether or not a game has potential for use in the classroom.

These four pillars are the following:

1. Gameplay—How is it as a game? Is it fun? Is it interesting? How does it measure up esthetically?
2. Educational content—Are there one or more recognizable educational objectives, discernible either from the game itself or from the accompanying support materials.
3. Teacher support—Is there adequate teacher support to make viable for use in a formal setting?
4. Balance—This part examines the game through the lens of the magic bullet model to see how well the various learning elements are balanced.

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Together these four pillars highlight the key issues associated with the use of games in the classroom.

Chapter Goals

- List important considerations in choosing a game for the classroom.
- Examine how teacher roles change when teaching with games.
- Understand the decorative media principle and how to avoid its trap.
- Learn how to perform Becker's Lazy Test to assess integration of educational components.
- Consider each of the four pillars and see how they combine to form a comprehensive analysis tool.

Key Terms

These are the terms introduced in this chapter. Definitions for these terms can also be found in the glossary.

- Four pillars of educational games
- Becker's Lazy Test
- Decorative media principle
- Decorative media trap
- Evaluator role
- Instructional design
- Instructional strategies
- Likert scale
- Playmaker role
- Teacher roles

6.1 Introduction

We have now considered the theoretical underpinnings of games from both the learning and the pedagogical perspective. We've had a look at some of the advantages and challenges of COTs games, and we've seen how the magic bullet model can be used to visualize potential learning in a game. It's time to see how we can evaluate games in a way that helps us decide if and how specific games might be used in the classroom. We need to make sure that our examination is not a superficial one but also that the process does not become so onerous that instructors avoid using games because evaluating them is too much work. The approaches outlined in this book are designed to allow fairly quick judgments, and to make them as simply as possible to determine if a game is likely to be a good candidate for particular purposes.

6.2 What's Important in a Game for Learning?

What makes a game suitable for use in the classroom? The answer to this question is not nearly as clear-cut as we might like. As it is with other forms of media, the criteria that make a game suitable for use are as varied as the uses to which it can be put. As we have seen, the criteria are different if we are talking about COTS games, ones specifically designed for use in the classroom, or those in between. They will also be different if considering a short-form game or one with extended play. Game scholars also vary on their ideas of what is important in a game for learning. Jim Gee, noted advocate for the power of games for learning, lists a number of qualities that would make a game suitable. These include replayability and immersiveness, that it builds expertise and identity, that it be transdisciplinary, and that it allows for different trajectories of expertise. They should also connect with the real world and create a community of learners (Gee, 2012). While admirable, it is unclear if they are always necessary and some may suggest that they aren't all even always desirable. Carrie Heeter, another noted game-based learning scholar, has a different description of an ideal educational game. Heeter says that it can be "an elegant experience that encourages and enables the target player to achieve the intended learning goal(s)" (Heeter, 2013). We've spent a fair part of this book looking at the theories and connecting the dots between them and games. It's time to find out from the teachers what *they* think is important.

In 2005, John Kirriemuir asked teachers what was important in games for learning and his list of requirements is as relevant now as it was in 2005:

- Examples from other teachers included teacher roles, how the game was used, costs, evidence of impact on students, and how the game was connected to curriculum. Teachers work very hard and have little time to try to figure out how to use a game in a classroom, especially if the designers have not provided assistance.
- Games should be "light": long expositions, videos, and narrations should be kept to a minimum or removed altogether; remove advertising; take out gaming elements that will never be used in the classroom.
- Positions and tasks: The game should be able to be started at a point (position) useful to the teacher. Daily lessons can begin in many different ways, and can end in random places. Teachers need to be able to pick up where they left off. They also need to have well-defined goals and objectives that teachers can use as homework or in-class tasks.
- The game must be accurate in the process and facts it conveys, and should avoid political or scientific controversy unless that is the point of the game. A game can remove the uninteresting parts of a simulation if they are not essential; time can be sped up (Kirriemuir, 2005). *Real Lives* is a game where players experience the life of one person from birth to death. Usually, when the player advances the timeline it goes ahead by 1 year, but occasionally something happens during the year and in that case the timeline only advances to that event.

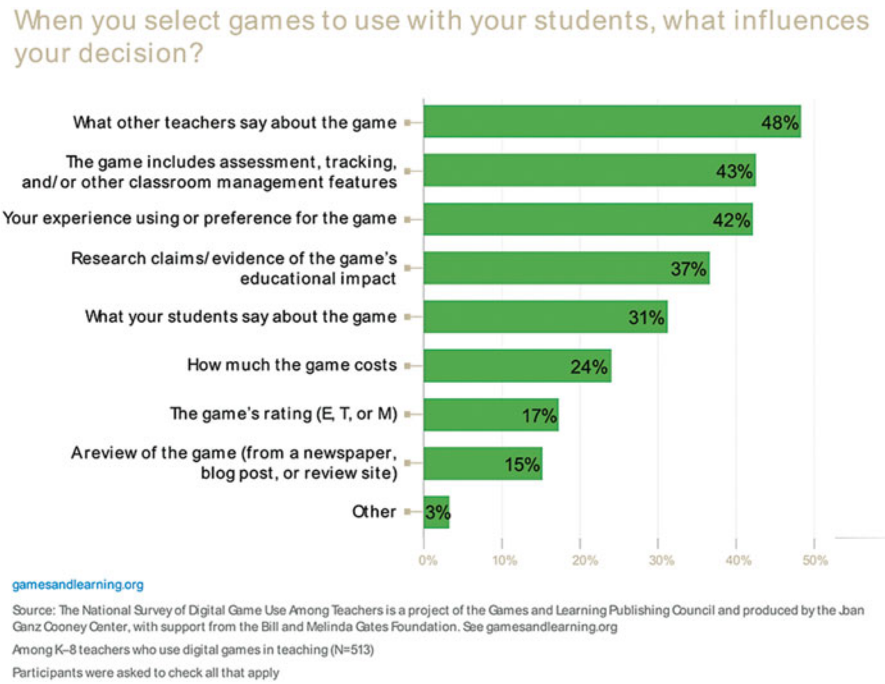


Fig. 6.1 Influences on game selection (Takeuchi & Vaala, 2014)

We know from the recent study conducted by Games and Learning (G&L) that the things that influence teachers' choices of games align very closely with what Kerrimuir found a decade ago (see Fig. 6.1). The G&L study found that what other teachers say is important, and that lines up nicely with Kirrimuir's first requirement. Assessment within the game touches on its connection to the curriculum as well as Kirrimuir's Positions and Tasks requirement. Also included as important in the G&L survey are research evidence, student opinions, and the cost of the game among other things (Takeuchi & Vaala, 2014). The evaluation approach described in this chapter addresses all of these.

6.3 What Roles Do Teachers Play?

We've already seen that COTS games present similar challenges to those of any other media that were not developed with education in mind. Those who design the instruction, whether they be professional instructional designers or the teachers who will be delivering the lessons, are left to make the necessary connections to the curriculum and the learning goals and outcomes. While games designed and built specifically for educational purposes may be easier to use in this respect, many still do not contain the kind of support that is typical of, say, textbooks. As a result, the roles that teachers play when using games in the classroom can be complex and shifting. In a study of how social studies teachers taught using a computer-supported debate game designed and built specifically for the study, Hanghøj was able to identify four broad teacher roles: instructor, playmaker, guide, and evaluator (Hanghøj, 2013). It is worth noting that in a subsequent study using actual computer games, teachers often took on fairly passive roles as observers, implying that learning to teach with games may not be as intuitive as we'd like it to be (Hanghøj, 2013). The four active teacher roles may then be something that require explicit support in digital games, and are worth considering when creating teacher materials.

- *Instructor*: This role includes the ways in which the teacher prepares the students for the game by explaining the learning goals as well as any direct instruction related to either the operational use of the game or the in-game activities.
- *Playmaker*: When acting as *playmaker*, the teacher communicates the tasks, roles, goals, and dynamics of the game, its narrative, or other scenario as seen from the perspective of the player.
- *Guide*: This role relates to the ways in which the teacher provides scaffolding to assist students in reaching the learning goals.
- *Evaluator*: Finally, teachers must also act in the role of *evaluator* to evaluate the game outcomes and students' learning experiences (Hanghøj, 2013).

It should not come as a surprise that teachers do not naturally adopt appropriate roles when using games for learning. After all, most have not been taught how to use games in their pre-service learning (Hamari & Nousiainen, 2015; Magnussen, 2007), and knowing how to teach using a particular technology is not necessarily self-evident (Emin-Martinez & Ney, 2013), especially if the teachers themselves do not have a great deal of experience playing games. Without adequate support, teachers often adopt a passive approach when first using games in the classroom, and the active role they do take on is likely to be that of referee (Novak & Nackerud, 2011). However, with adequate support both through game resources and through better teacher training, they can play more active roles such as the ones outlined by Hanghøj.

6.4 Decorative Media Principle

Make no mistake, first impressions are important. They can establish credibility or imply innovation, but first impressions are not enough. To be effective, serious games must also have depth and substance, or they run the danger of falling into the phenomenon I call the *decorative media trap* (Becker, 2012). This is the misapprehension that a pleasing or impressive appearance implies that the artifact is well designed. When the visual design is the most significant feature of a serious game and other aspects of the design receive insufficient attention, users of this object risk falling into that trap. Designers can also fall into this trap when they believe that appearances are either sufficient or, worse, can compensate for poor or mediocre message design. This often comes from a failure to fully understand the *decorative media principle*, which is the creation of a visually pleasing background and decorations for a worksheet, website, game, etc. that is thematically connected with the message being featured.

The challenge of integrating learning objectives with the delivery medium is far from new. In some instances, it is easier than in others. We've been doing this sort of thing for decades, such as in worksheets for drill and practice. It is common to create a visually pleasing background connected with the current theme—especially in the lower elementary grades and I have done it myself. In my "Ducks in the Classroom" project, I have vocabulary and word games that can be created on pleasing backgrounds that connect with the words used in the exercise—a nest, words enclosed in images of eggs, duck footprints, etc. This idea of decorating a worksheet works well for a great many themes, and can be applied effectively and generically. Need a worksheet related to Louis XIV? Add some pictures, maybe a few quotes, and if skillfully done, we have added value, fun, and even connections for the learners to capitalize upon.

The pedagogical aspect of the principle is that the decoration supports learning and retention by increasing interest (Robertson & Howells, 2008), as well as strengthening the *conceptual coherence* of the learning object. At least sometimes, the decorations can help learners form connections by giving them visual tags upon which to hang ideas and facts. Adding to the visual appeal can boost the impact of what you're trying to get across, and this sometimes works even if the connection between the decoration and the content is weak. Something that has clear unappealing or disturbing decorations can even detract from learning.

The same principle often works reasonably well for instruction delivered via a website—so long as the website is primarily organized as print transferred online. Taking online delivery another step further, the principle still largely holds, even when there are various interactive elements on the website or CD. The Hatching Project Candling Tutorial is a case in point. It includes many images, video, and self-tests, and it has received many positive reviews from all over the world, but aside from the nonlinear interconnections, it is still many orders of magnitude less complex than a computer game.

Unfortunately, when applied to fully interactive media and specifically games, this decorative media principle does not translate well and is simply not enough. The result is often a game that is little more than a wrapper for the instructional materials.

Rather than incurring the wrath of well-meaning, but misguided edutainment developers by pointing to specific examples, let me offer a purely hypothetical description. Imagine a game that starts off as many typical commercial games do, with cool images and some sort of backstory—you are the world's last hope, and must use your superhuman powers to save mankind, and some sort of quest or challenge that must be overcome—defeat the enemy, or recover the lost treasure. But then, when the gameplay reaches a crucial moment, a new screen pops up showing what any child over the age of 6 can identify as a learning exercise, and the world-saving task to be accomplished turns out to be solving a quadratic equation. The answer to this equation, for some thinly justified reason, is the key. Even though the resultant number has no connection to the rest of the story, it is some kind of magic number that defeats the enemy. Even worse, this "embedded worksheet" looks nothing like the rest of the game—in fact, it looks suspiciously like the paper worksheet that was used in the same class the year before. This is what has become synonymous with "edutainment," and as we already know, that's not good.

To be fair, there are some wonderful examples of fun games that employ this principle effectively. The kewlbox game called *Chicktionary* (formerly Fowl Words) is one already mentioned in previous chapters. This game is little more than an interactive worksheet, but even though there is no thematic connection the artwork, sounds, and design make it a great deal of fun. Part of what makes this particular game work is that it does not pretend to be more than the simple puzzle it is.

Another example that has been also used before offers a stark contrast. It is part of a website about Internet security for kids called *Privacy Playground*. Visually, it is quite nice and the cartoon characters are even sort of cute. We get the first hint that something may be amiss when we meet their main emissaries: the CyberPigs. The "game" is a perfect example of the decorative media principle when it has utterly failed. After sitting through numerous screens full of "lesson" setup, we get the "game" part: a yes-no question! Perhaps the misunderstanding comes from television game shows where the only game mechanic is asking questions, but in most other circumstances a quiz or test would not be confused for an actual game, and it shouldn't be mistaken for one in educational media either.

There are countless examples of the decorative media principle in action—some that have "games" and some that don't. It may even be that the mis-application of the decorative media principle is something that starts in early childhood. At that time, it comes from a pure and innocent desire to make things more attractive by adding pretty backgrounds, pictures, and fonts. There is nothing wrong with that and this kind of experimentation and practice deserves to be encouraged. However, at some point, we need to grow beyond simple decoration, especially in those situations where we actually want to communicate something. At some point we need to help kids understand that it's NOT OK to spend 95 % of their time working on a presentation trying out different fonts and backgrounds and hunting for clip art and only 5 % of your time on content. At some point teachers need to be less impressed with how things look and pay more attention to what is actually communicated.

This applies to the rest of us too. The medium is only PART of the message. The medium must be more than a simple vehicle for delivery and it is essential for designers to understand their tools thoroughly.

That having been said, the benefits underlining this principle are that, when done well in educational games, the decorations can indeed help learners form connections by giving them visual labels or tags upon which to hang ideas and facts.

Adding to the visual appeal can also boost the impact of what you are trying to get across, and this sometimes works even if the connection between the decoration and the content is weak. When done right, decorative media can provide scaffolding for learning and reduce cognitive load.

6.5 Becker's Lazy Test (a.k.a. the BLT)

Becker's Lazy Test is something I developed some years ago as part of the 4PEG game assessment template (4PEG = 4 pillars of educational games). When examining a game, I play it and see how far I can get without reading or learning anything. I simply follow the known mechanics, if obvious, or click randomly. If I can get to the end this way, it does NOT pass as an educational game. The easier it is to progress in the game using this strategy, the worse the educational value of the game.

Put simply, it should not be possible to get through an educational game by brute force or by random chance alone. This may seem very similar to Margaret Gredler's claims about games vs. simulations made in her chapter on simulations and games in the 1996 AECT Handbook of Educational Technology (Gredler, 1996). In it she said that games should not have a random factor. Now, if you've read my book, The Guide to Computer Simulations and Games (Becker & Parker, 2011)—especially the chapter on randomness—you will already know how important the "random factor" is to BOTH simulations AND games. Gredler used randomness as a way to distinguish simulations from games (which is misguided), but she also used this as a way to separate games she liked from those she found frivolous. Part of what Becker's Lazy Test is looking for is whether or not random actions *on MY part* (as a player) can get me through the game. Every game can, should, and MUST have at least some randomness, or else it is nothing more than a branching story.

These are the questions that go along with Becker's Lazy Test. A *yes* answer to any of these constitutes a pass, and a pass is a bad thing.

- Is it possible to get through the game by randomly clicking on things? In other words, could I win the game by simply memorizing which things to click without knowing what those things are?
- Are the educational objectives included among the required learning in the game? Can I learn the game without learning the educational part?
- Is it possible to get through the game while ignoring the learning objectives? The required learning in the game should be PART of the game and not only found in pop-up screens of text or told to me through dialog.

The BLT asks if a lazy player can get through the game without learning anything, and it is one element of the four pillars of educational gaming, listed as part of the educational content pillar. Becker's Lazy Test focuses on how well the learning objectives are integrated into the game by determining whether it is possible to get through the game without paying attention to the learning goals of the game. If it IS, then the game passes the test, which in turn means that the learning objectives are NOT well integrated into the gameplay.

6.6 The Four Pillars

It has finally come time to put everything we've learned so far together into a comprehensive rating tool. This tool is represented by the four pillars of game-based learning (Fig. 6.2) and shows using examples how they can be used to perform a structured analysis of both COTS and serious games to assess what kind of potential, if any, a game has for use in the classroom.

These four pillars are the following:

- *Gameplay*—This pillar considers the game itself: How is it as a game? Is it fun? Is it interesting? How does it measure up esthetically? Educational media need not always come in game form, but if it is being labeled as a game, then it must have these essential qualities.
- *Educational Content*—This pillar is the one that addresses the learning component. Are there one or more recognizable educational objectives to be found in

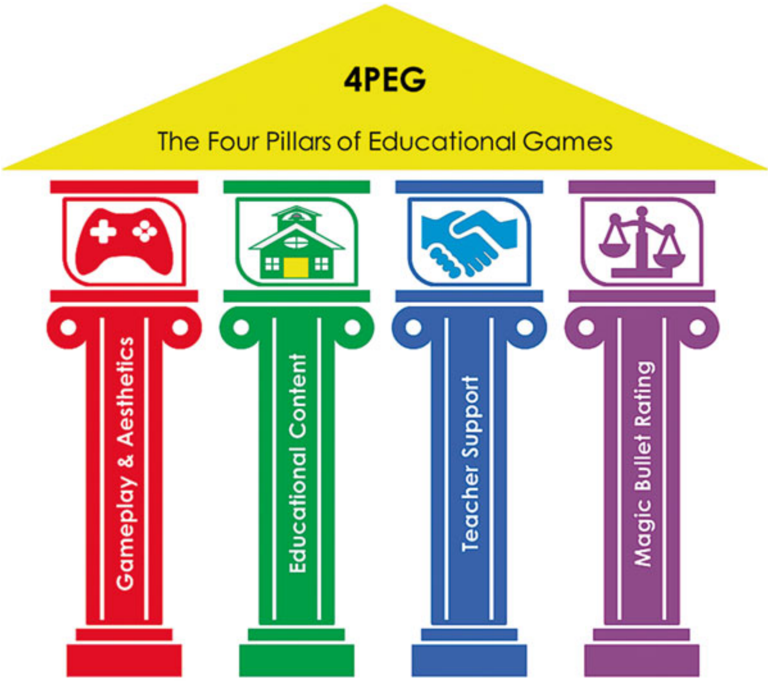


Fig. 6.2 The four pillars of game-based learning

this game that are discernible either from the game itself or from the accompanying support materials?
- *Teacher Support*—An often overlooked aspect, the third pillar has to do with the nature of the support available to teachers who might want to use this game. Is there adequate teacher support to make it viable for use in a formal setting?
- *Balance*—Finally, this section examines the game through the lens of the magic bullet model to see how well the various learning elements are balanced.

Together, these four pillars highlight the key issues associated with the use of games in the classroom. Each pillar has a number of categories where the game can be rated on a scale of 0–5 so that each pillar can be summed up with a single value. These in turn are then added up to result in a single number out of 100 that is the game's score.

Although the scores are still subjective, they all use same scale and careful consideration has gone into organizing the various aspects according to their relative importance. The measure for each line in the rating instrument is effectively a *Likert scale* with the following values:

5 = Excellent (A)—These are things that impress you. They are really well done and they kind of excite you.
4 = Good (B)—These are good. They serve the purpose they are supposed to serve and have very few flaws.
3 = OK (C)—These have some flaws, but overall are OK. They function well enough but really aren't anything special.
2 = Fair (D)—These have a greater number of flaws or missing qualities. They have some glitches or problems, and if a new version of the game were to be produced, the problems in this element should really be addressed.
1 = Poor (F)—This is for elements that really don't work right, or miss the mark in some significant way. They exist, but aren't fulfilling their purpose.
0 = Missing—This is for an element that should be there, but isn't.

It is important to note that a lower score does not mean that the game contains no educational potential. We will come back to this idea after looking at the details of each pillar.

6.6.1 Gameplay

The first pillar is that of gameplay (Fig. 6.3). The gameplay ratings are intended to assess the quality of the game as a game apart from its potential as an educational object. This pillar contributes 30 % to the overall rating, which means it is important. If the object being rated does not score reasonably well as a *game*, then how does it help? There are many ways to design interactive educational experiences that are not games. Good games are hard to design so if it's not much good as a game, then it should have been something else. Even worse, a good lesson wrapped up in a bad game doesn't help.

Fig. 6.3 Gameplay pillar

The gameplay pillar is rated according to six different aspects. Each one is intended to provide us with information about the game that will help us decide if it is likely to be good fit for our purposes.

6.6.1.1 Content and Originality

Are the game elements well developed and appropriate for the game? A mismatch of game elements with the educational goals may end up being detrimental to learning. An inappropriately funny game can undermine a serious topic. A shooting game where players have difficulty aiming their weapon and shooting is not helpful.

Does the game show original thought? It is not necessary that every game be unique, but it should have at least some aspects that distinguish it from others.

Does it follow accepted norms for the genre?—OR—Does it have new take on known genre? Players quickly learn to expect certain kinds of things from certain genres of games. A game can take a unique approach but it must still fit with the overall theme. For example, in the puzzle game *Machinarium*, players can ask for hints when they become stuck, but as this game, it has no dialog whatsoever. Help pages consist of only pictures, and are themselves a form of puzzle.

6.6.1.2 Game Mechanics

What can you do in the game? Recall that game mechanics are actions that the player can perform in the game. Many Web-based games are effectively point-and-click games where players use only their mouse. This limits the action somewhat but does not mean that the game must consist only of obvious buttons.

Are the controls logical and easy to use? A game that is difficult to learn is unlikely to be a viable candidate for use in a single class or short unit. The amount of time it takes to learn the game relative to the amount of time one can play also affects its usefulness. A short-form game should be very easy to learn. Frustrations in learning the game interfere with learning goals.

Does each level fit the overall style of the game? A multi-level game is in some ways like a chapter book. Unless it is clear that each level is effectively its own game, levels should all combine to form a coherent set.

6.6.1.3 Game Progression

The transitions between levels (which need not be traditional levels) go from simple to challenging and are smooth and appropriate for the game. It is common for the first level to be some sort of tutorial that players can use to learn how to play, and the first "real" level is often quite simple. The two main approaches to level progression are a steady increase, or a somewhat exponential one, in which the increase can include more space to explore, more challenges, stronger opponents, and so on. This is usually combined with greater rewards as well. If most of the game uses a steady progression for most levels but has one or two out of balance with the rest, players will notice and likely not be pleased.

6.6.1.4 Artistic Design

Artistic design considers the overall style of the game. Is it visually attractive? Often, educators think of big-budget games with rich, realistic characters and assume that a game must have the same artistic qualities in order to be good. Independent and educational games rarely have the kinds of budgets that allow for *Assassin's Creed* graphics, but should still be visually pleasing.

Does it make me want to try the game? Like it or not we are often attracted to a game first by its appearance. Some are cartoonish, like *Privacy Playground*, and some are quite stylized, like *Limbo*, which is a side-scrolling puzzle game set almost entirely in monochrome shadows and silhouettes. Both are visually pleasing, but very different.

Are the graphics appropriate for the game? Whatever the artistic style, it should be a good fit for the kind of game it is. Part of the appeal of the game *Limbo* is precisely the fact that players can't see anything clearly and as a result otherwise simple moves become fraught with potential danger. The spiky shapes in the ditch could be harmless grass or rigid spears.

6.6.1.5 Set, Settings, Characters, and Costumes

This property also considers artistic aspects, but on a smaller scale. Does the style of the settings seem to be appropriate for the game? Do the characters support the overall impression of the game? Do their personalities fit with everything else? Here again it is important that the appearance of the surrounding environment as well as the characters in the game all work in harmony with each other to create a coherent experience.

Is it appealing and distinctive? Does it have sufficient variety? Is it original or appropriate? Discord in the design can actively interfere with the player's ability to focus on the game.

6.6.1.6 Audio

Is it appropriate for the game? People often underestimate the importance of the audio in a game, but all we need to do is watch a scary movie while playing silly music and the whole feel of the film is changed. The same is true of games; but, in some ways it is even more of a challenge. Linear media like film and television have a known length, but games can go on and on. As a result, any music in a game will have to loop somehow, or be procedurally generated. The latter is difficult to do, so most games have scores that loop, and these can become irritating rather quickly—especially to people around the game who are not actually playing.

Is the music necessary to the game? Can it be easily switched off? Are the sound effects separate from the music and can they both be controlled separately?

Is the audio appealing? Distinctive? Is there sufficient variety? Is it an original composition or if not, is it appropriately credited? Here too the audio can be an asset or a liability.

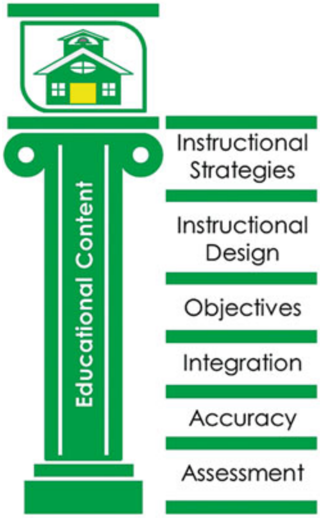
6.6.2 Educational Content

The next pillar is educational content (Fig. 6.4). This pillar also carries a weight of 30 % of the overall score. This is where we assess the quality and extent of the educational potential in the game. Normally, this should be considerably easier to do in a game designed specifically for education, but this is not always the case. While most educational games are designed with specific educational learning objectives (ELOs) in mind, COTS games aren't. Therefore, it is possible to create multiple evaluations for this section, depending on which ELOs you are using.

6.6.2.1 Instructional Strategies

An *instructional strategy* is a plan for what will happen during the course or lesson. It includes such approaches as questions and answers, role-play, group discussion, dioramas, tests, reflective writing, and so on. When applied to a game, this category includes what kind of strategy is being used in the game to help people achieve the ELOs. This relates to gameplay, but is specifically focused on how well the gameplay matches the intended learning outcomes. For example, a guessing game or drill and practice may be appropriate for learning anatomy, but not for Mendelian genetics. Are the chosen instructional strategies appropriate?

Fig. 6.4 Content pillar



6.6.2.2 Instructional Design

Instructional design is the process of creating instruction through the analysis of learning needs and the systematic development of learning materials. It can take many forms and we will look at instructional design in general as well as game-specific design models in Chap. 8. For now, we look only at Merrill's (2002) First Principles of Instruction. Because of its relative simplicity and the fact that these principles really encompass the elements of all other instructional theories in one way or another, it was decided to use this theory as the benchmark against which the instructional design component of the game would be measured. Is the design in keeping with Merrill's First Principles of Instruction? Recall from the discussion of the First Principles in Chap. 3 as part of the instructional theoretical underpinnings of games; there are five fundamental elements that must be part of any instructional intervention if it is to be sound. Again for simplicity, each principle is assessed as either pass or fail, and the score for this category is the sum.

1. *Problem*

   Does it engage learners in solving real-world problems, or if not, are the problems ones that can be applied to real-life problems? It is not always necessary that a game have a direct real-world applicability. For example, in *Black & White*, the players' progression through the game is affected by the choices they make—they can play as a good or bad deity and they can switch between them at will. The setting is not what most would think of as a real-world setting—how often in life does one get to be the god of a bunch of villagers?—but the moral choices and their consequences do apply to real-world problems, so I would pass this game for addressing real-world problems.
2. *Activation*

   Does it activate existing knowledge as a foundation for new knowledge? Think about what assumptions are made with respect to what players are expected to know at the start of the game. If intended to introduce a new topic, there may not be much assumed content knowledge, but there might be some operational gameplay knowledge that is assumed. Does the game do a good job of tapping into what players already know?

3. *Demonstration*

   Does it demonstrate new knowledge to the learner? Generally speaking, this is one place where many commercial games excel. If they were not good at helping players learn what they needed to learn in order to get through the game, it would not become a popular game. In a game used for learning it is important that players not become so frustrated trying to make progress that they give up. Even if the entire game is based on a discovery learning approach, there still has to be a way for players to target their efforts in order to get through the game.

4. *Application*

   When the player learns something new in the game, is he or she provided with opportunities to use it within the game or is he or she simply given "factoids" as an afterthought? Since we are looking at the educational component of the game things like learning how to make one's avatar jump a chasm don't count unless we're trying to learn about the physics of jumping. This part, like all the others here, is focused specifically on the application of new educational knowledge.

5. *Integration*

   Does the game help learners integrate that new knowledge into the learner's world? Reflection and connection to the real world in games is often one of the weaker aspects. It is important to know whether or not the game helps here, but this is something that is often done better by the teacher, so failing this component is not necessarily a serious problem.

6.6.2.3 Objectives

Most educational games will have specific ELOs such as learning the multiplication tables or understanding wetland ecosystems. A COTS game will likely not have this. Some can even be used in many different ways and so there may be a variety of ELOs for which it can be used. This category rates the extent to which the game supports the objectives you have listed. Are the ELOs included among the required learning in the game? Does it appear to meet the ELOs? Since we are not testing this game in the classroom, we are making a reasoned judgment here. Even with classroom testing, it is not possible to guarantee that any particular objective will be met in an educational object like this, but it is possible to assess whether or not it provides the necessary raw materials.

6.6.2.4 Integration

The integration we are talking about here has to do with how well the learning objectives are woven into the game itself. In a serious game, it is essential that the desired learning outcomes be part of the required interactions of the game. This is where we apply Becker's Lazy Test to see if it's possible to get through the game without learning anything. It is not necessary that everything that can be learned be integrated into the gameplay—there's nothing wrong with offering additional information in the form of (optional) pop-ups or by other means, but if the core learning is delivered this way then that is a problem. Similarly, if the game is little more than a wrapper for the educational content, then it is not well integrated. There are many examples of quiz-style games where the "game" part consists of questions the player must answer correctly that can be used to present any kind of factual question in virtually any topic. If the core learning can be swapped out and replaced with a different set of questions, then this game should score a zero in this category.

6.6.2.5 Accuracy

Does the game contain accurate information? Most of the time we would want those parts of the game that relate to our ELO to be accurate. Even though no game can be completely accurate, it is crucial that all of the facts associated with the ELOs be correct, and that the needed concepts and principles are clear. There should be nothing here that is misleading. That the historical facts in *Assassin's Creed* are relatively accurate is precisely what makes it a viable choice for use in a history class. The same thing is true of *Angry Birds*. It is precisely because the physics of the trajectory paths followed by the birds are mathematically accurate that this game is useful. On the other hand, factual inaccuracies can also create teachable moments, but it should not be presented as a surprise. In other words, learners should know ahead of time if they are to assume that the game they are playing contains correct information or not. A perfect score in this category implies that all of the information in this game that relates to the current ELOs appears to be accurate, and a zero indicates that none of it is.

6.6.2.6 Assessment

Most popular commercial games are pretty good at doing assessment. Some games use a simple score but many have a fairly complex set of measures that players can use to determine their standing. *Angry Birds* uses a fairly simple three-star scoring mechanism. Players are awarded one to three stars, depending on their score which is in turn based on how much of the structure you have managed to knock down with your birds. Players also get bonus points for "unused" birds. One star is sufficient to win the game, but many people continue playing the same level to try and earn a three-star score. Although there is no specific scoring in *Animal Crossing*, there are still a variety of ways to measure progress such as earning "bells," which is the in-game currency, being able to grow rare flowers, or earning badges for various activities. Here too the scoring is intertwined with learning. In order to earn badges for fishing, players must become proficient at fishing and must learn which fish can be caught when and where.

The question we are answering with this category is whether scoring in the game is related to the learning content? If *Angry Birds* is being used to teach physics, then the scoring is indeed related to the ELO since players need to understand how to predict the trajectories in order to get a good score. *Animal Crossing* could possibly be used to learn how to identify various kinds of fish as the images of the fish are quite well done, but the scoring mechanism in the game doesn't help. Fish in the game can be sold to the store for a set price that varies by species, and some fish are very rarely caught while others are fairly easy to catch. However neither of these scoring mechanisms relate to the player's ability to identify fish because fish appear as silhouettes under the water until they are caught. Like the other categories in this pillar, it is important to remember that the score tells us about the connections of the game to our ELOs but a low score does not always indicate that the game is not suitable. It does, however, help us to understand what we will need to do in order to make use of this game in a classroom setting. In some cases, a game could be used as is and the scoring mechanism can be used to indicate whether or not the learners have met the ELOs. In other cases, we need to build our own assessment tailored to our ELOs outside of the game.

6.6.3 Teacher Support

The second to last pillar (Fig. 6.5) addresses the level and quality of the teacher support that is easily accessible, either with the game itself or elsewhere. There are a growing number of games used in educational contexts and, for the most part, teachers are generous when it comes to sharing what they have built and learned. Unfortunately, these can sometimes be difficult to find, and it really helps no one if there is a stellar teacher's guide but it cannot be found. The following are questions to consider when assessing the quality of the teacher support for a game.

Although some producers have embraced the use of their games in formal education, like those who created *Portal 2* and *Minecraft*, most COTS games lack the teacher support component. A game lacking teacher support will require more preparation than one that has it. This pillar does not carry the same weight as the other two. It is an important component to be sure, but should not count towards the final score to the same extent as the game overview and the educational component. The teacher support is something that can be added after the fact if necessary, but a poorly designed game has features that may not be surmountable. It is worth 20 % of the final score and consists of four categories, each worth 5 points.

6.6.3.1 Teacher's Guide

Score a 2 or better if a teacher's guide exists and is easy to find. How long you had to look for the resources you found is one aspect of the score. To illustrate this try doing a Google search using these two terms: ***webquest flight***. The first page of hits

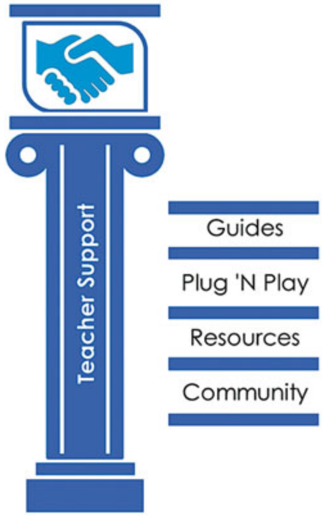


Fig. 6.5 Support pillar

is likely to be several ready-to-use webquests about flight. Many include information about the grade level, activities, and student evaluation—likely all created by actual teachers. This is most of what you will need to use that lesson in your classroom tomorrow. It will have taken you just a few minutes to find them; have a quick look at them, and pick one you can use tomorrow. Then try another search: "***educational game***" ***flight***. Even putting quotes around "educational game" to narrow the search, you are likely to end up with links to some articles, some research papers, a few flight simulators, and various bits of things to do with flight OR games.

The chances you will find anything that you can use directly in your class tomorrow is slim to none. While there are a growing number of games out there that have educational potential—both big and small, almost NONE of them are useful immediately. Most still require the teacher to play the game, analyze it, and build a lesson from scratch, including assessments that the principal will approve of AND ties to the required curriculum so that the use of that game can be justified to administration. Being able to access teacher support easily can mean the difference between a particular game being useful and useless.

Once you have determined whether or not the support materials were easy enough to find, ask if it is clear how to use this game. Support materials should include such things as:

- A description of game play.
- Content description (documentation) that is well organized.
- Any required special permissions/skills to install or run that are clearly identified.
- Installation and execution processes that are clearly identified and easy to read and follow.
- You should be able to see how the game will play.

6.6.3.2 Plug N' Play

In order for this game to score high in the Plug N' Play category, the teacher support materials should include lesson plans with thorough instructions for using them in the classroom (or other target environment). Like the webquest example, in order to score well, it should not require a large time investment to make it "teacher ready."

6.6.3.3 Supplementary Resources

This includes any additional information specifically for teachers, such as background on both the game and the topics it addresses, ways to use the game, and where to get help. For full points, these resources should be complete and readable to your satisfaction.

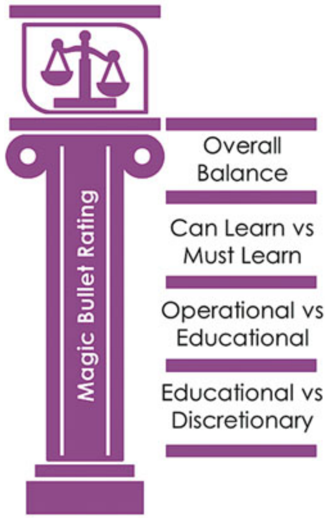
6.6.3.4 Community

A key aspect of many popular commercial games is that they have extensive and vibrant communities to turn to for research, support, and sharing. This is at least as important for learning games. For full points here a community specifically to help teachers must exist where teachers can go for help and support, and to share ideas, experiences, and ways to use the game. This community should be clearly identified and easy to find. Some games have more than one community but in our case it is best to have a single place associated with a game. Most games still do not provide places where teachers can have discussions or contribute lesson plans or other resources as most games are commercial endeavors and many companies don't realize the benefits that can come from providing such spaces. It is unclear whether it would be better to create external communities, but many utilities exist that could be used for this such as publicly accessible free wikis, or cloud-based applications such as Google Drive.

6.6.4 Magic Bullet Rating

The final pillar relates to the magic bullet model (Fig. 6.6). As we learned in the previous chapter, a particular configuration of the various kinds of learning in a game does not necessarily indicate that a game is good or bad, but it does help us to understand how the various components are distributed. This pillar makes use of the magic bullet to consider four key perspectives and thus there are four categories. In each of these categories the rating is determined by how well the balance of the elements fits the type of game it is, its intended use, and audience.

Fig. 6.6 Balance pillar



6.6.4.1 Overall Balance

This category looks at the overall balance of the learning in the game in light of the intended application. Here we seek to answer the question of how well the relationship between the four main categories matches its intended use? For example, in a game like *Gone Home* I am able to explore at will and I can learn many things that do not necessarily help me achieve the game goal; yet they are still entertaining. In a game like this the potential for coincidental learning is quite high. If this game is to be used as a literary "text," then this balance would be highly appropriate so it would likely score a 5.

6.6.4.2 Can vs. Must

Here, we can ask again if the game passes or fails Becker's Lazy Test, but in this case we are interested in how the educational elements measure up against the others. If all of the educational elements are in the can-learn space, then it would likely pass the Lazy Test, remembering that passing this test is undesirable. On the other hand, if all of the educational elements are part of the must-learn space, then the game has good integration, but if the must-learn space is considerably smaller than the can-learn space this could indicate that players might spend a lot of time in the game that will not help them learn what they need to learn.

6.6.4.3 Operational vs. Educational

How much of the time spent in the game has to do with just learning to play the game? Is the required operational learning appropriate for the game's intended purpose? A game intended for use in a single class period should have a very small operational learning component whereas one that will be used over a longer time can afford to have more. This category rates the appropriateness of this balance.

6.6.4.4 Educational vs. Discretionary

Finally, is there an appropriate balance of learning and fun? Recall that discretionary learning is that which is neither educational nor operational. We need to keep in mind that we are talking about games—and they should be at least engaging even if they are not exactly fun. We have probably all watched films that we found very engaging, but we'd be hard pressed to describe the experience as fun. I don't think most people would describe Schindler's List as a "fun" movie, but it is an engaging one that many people willingly undertake. Games should have some sort of discretionary learning or else there is not much point in having a game in the first place.

6.7 Summary

Our understanding of educational game design is still evolving, and one of the challenges is how to combine approaches to game design with approaches to instructional design in a way that results in a game that works both as a game and as instruction. We will look more at this in Chap. 8, but for now, let's see how this relates to the 4PEG model and our ability to identify games we can use in the classroom.

Games are often designed around some metaphor which is in turn meant to embody some sort of concept. Unfortunately, the metaphor may not be universal. If the connection between the concept we are trying get across and the metaphor used as the "vehicle" is not clear enough, players will focus on the mechanic but completely miss the connection between the metaphor and the thing they are supposed to be learning. The USDA game *Blast Off*! is an educational game for kids meant to teach them about balancing foods in the four main food groups. It does this using the metaphor of fuel for a rocket to mean food for us. While the game may be fun for kids, they may miss the point if they become too focused on simply collecting the right kinds of foods to launch the rocket.

Another common problem happens when a game is built around a single mechanic when that one mechanic represents an action out of context from the concept/skill to be learned. An example of this is a game called *Fission Impossible*. This game was briefly discussed in Chap. 5 when we looked at games where what we must learn is considerably less than what we can learn. Recall that the object of the game is to get the neutron (represented by an orange ball) to collide with uranium, which is in turn represented by a green ball. The goal of the game is fairly easy to figure out without knowing anything about what the objects on the screen represent. We need to get that orange ball into the place where the green ball is. Why do we need to get the orange ball into the virtual basket with the green ball? Who cares? Would that knowledge help me win the game? Nope. This game passes the

Becker's Lazy Test with flying colors. It may look nice and have all the usual trappings of an arcade-style twitch game, but as an educational game it fails. The 4PEG assessment of the game would highlight this.

It is important to remember though that final numeric score that represents the sums of all the other scores is not to be viewed like an exam score. A low score doesn't necessarily mean that the game has no potential as a learning tool. The point of the variety of categories in each of the pillars is that it provides us with a detailed, but straightforward analysis of the game's strengths and weaknesses. A low game score may be tolerable if it has a high content and support rating. Alternately, a low support rating may not be important to you if you have the experience and the time to develop your own materials. This is a subjective rating tool, so it is important to include additional comments whenever possible. Once a game has received a sufficient number of ratings from various sources we will be able to see trends in the evaluations. Wildly different ratings in the same category would indicate that this part deserves a closer look—perhaps the evaluators had different goals in mind. On the other hand, the more consistent the ratings, the more confidence we have.

The next chapter will work through a few examples, so we can see how the model works.

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Chapter 7
4PEG in Action

"Appropriate practice is the single most neglected aspect of effective instruction."

(Merrill, 2001, p. 464)

At-A-Glance
This section provides a detailed analysis of several games using the model described up to this point. For each game, I outline the more general analysis as described in Evaluating Games, and then proceed to a more detailed analysis of the learning potential using the Magic Bullet model.

This section includes images and graphics, but the book website can provide color images while the print edition can use black and white.

Chapter Goals
- Demonstrate the 4PEG review process and look at what we can learn from this.

Key Terms
These are the terms introduced in this chapter. Definitions for these terms can also be found in the glossary.

- Freemium
- Mini-game

7.1 Introduction

Now that we've had a close look at evaluating games, it's time to conduct a few and see what we can learn from them. In the last chapter, we look at the details of the 4PEG model. We look at each pillar in turn and see the kinds of questions we should ask ourselves as we analyze a game. Figure 7.1 shows the numeric summary that is the result of a complete 4PEG analysis. There are 20 items to score, organized into

K. Becker, *Choosing and Using Digital Games in the Classroom*, Advances in Game-Based Learning, DOI 10.1007/978-3-319-12223-6_7

Game Review V7
<enter name of game here>

Overall Rating	OK [3]	2.5	50	/	100

Summaries

Game Overview	2.5	15	30
Gameplay	4.0	12	15
Art & Audio	1.0	3	15

Educational Overview	2.5	35	70
Teacher Support	2.5	10	20
Educational Content	2.5	15	30
Magic Bullet Rating	2.5	10	20

Game Overview	2.5	15	30
Content & Originality		5	/5
Game Mechanics		4	/5
Game Progression		3	/5
Artistic Design		2	/5
Setting & Characters		1	/5
Audio		0	/5

Educational Content	2.5	15	30
Instructional Strategies		5	/5
Instructional Design		4	/5
Objectives		3	/5
Integration		2	/5
Accuracy		1	/5
Assessment		0	/5

Teacher Support	2.5	10	20
Guides		1	/5
Plug N' Play		2	/5
Resources		3	/5
Community		4	/5

Magic Bullet Rating	2.5	10	20
Overall Balance		1	/5
Can Learn vs Must Learn		2	/5
Operational vs Educational Learning		3	/5
Educational vs Discretionary Learning		4	/5

Fig. 7.1 4PEG game review template

the four pillars. The score for each sub-item is shown, as well as the pillar totals. Each line item and each category is shown with both the raw score, and an adjusted score out of 5. This is done so that the rating for each category can be compared to any other category. The game and educational elements are separated so we can look at the rating for each. In the example shown the game overview has a score of 3.0 and the educational overview has a score of 2.5. The template shown below is implemented as a spreadsheet that handles all the calculations. That way the reviewer only needs to enter the score for each of the 20 items.

The goal of this summary is to allow us to zero in on specific parts and see the scores for groups of related items easily. The example shown in Fig. 7.1 works equally well as a game and as an educational object. This summary lets us see which parts scored high and which didn't.

The following sections present the separate reviews of seven different games. We start with a news game called *September 12*. It was chosen here because it is a short form game. The next three: *Osy Osmosis*, *Math Blaster*, and *Real Lives* were all designed to be educational games. *Math Blaster* has been around a long time and has undergone a number of significant revisions. The version that is reviewed in this chapter is the online one available in 2015. *Osy Osmosis* and *Real Lives* are considerably newer. The next game, *Gone Home* is an independently produced game that was built purely for entertainment, but has garnered attention as a game that could be studied as a story. The final two started out as entertainment games, one produced by a sizable professional game company; the other is another independently produced game. The developers of both *Minecraft* and *Portal 2* have produced versions specifically for education, largely in response to requests from teachers who saw the potential in the games. It is the educational version of each that is reviewed.

7.2 September 12

September 12 is a news game about the concept of terror and terrorism. It focuses on the civilian bystanders in these situations and one aspect of the effect it may have on them (Fig. 7.2).

Publisher: Newsgaming
Developer: Newsgaming, Gonzalo Frasca
Release Date: 2003
Genre: Game for Change
Perspective: Isometric side-scroller
Audience: Young Adult and up

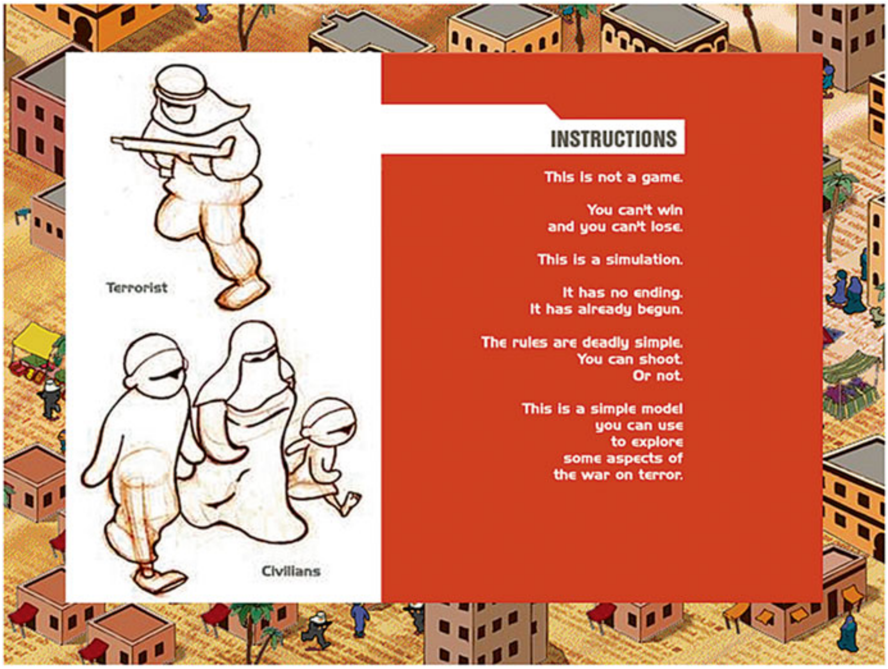


Fig. 7.2 September 12 title screen, image © Gonzalo Frasca, 2003–2016

Table 7.1 4PEG summary of September 12

Overall rating				**OK** [3]	**3.2**	**63/100**	
Summaries							
Game overview	**3.8**	23	/30	**Educational overview**	**2.9**	40	/70
Gameplay	**3.0**	9	/15	Teacher support	**0**	0	/20
Art and audio	**4.7**	14	/15	Educational content	**3.5**	21	/25
				Magic bullet rating	**4.8**	19	/25
Game overview	**3.8**	23	/30	**Educational content**	**3.5**	21	/30
Content and originality		5	/5	Instructional strategies		5	/5
Game mechanics		4	/5	Instructional design		3	/5
Game progression		0	/5	Objectives		5	/5
Artistic design		4	/5	Integration		2	/5
Setting and characters		5	/5	Accuracy		3	/5
Audio		5	/5	Assessment		3	/5
Teacher support	**0**	0	/20	**Magic bullet rating**	**4.8**	19	/20
Guides		0	/5	Overall balance		5	/5
Plug N' play		0	/5	Can learn vs. must learn		4	/5
Resources		0	/5	Operational vs. educational learning		5	/5
Community		0	/5	Educational vs. discretionary learning		5	/5

Subject: Social Studies, History
Grade(s): H.S.
Platform: Browser
Cost/License: Free

7.2.1 *Game Description*

The overall intent of this game is clear. The main message of the game is that violence begets more violence. The game consists of a Middle Eastern village with villagers going about their business. Some of the people in the village can be identified as terrorists by their clothing. The player controls a missile that can be fired. It is not possible to hit any target without collateral damage. Civilians who come to mourn those killed sometimes turn into terrorists (Table 7.1).

7.2.1.1 Summary Review

This is a very simplistic game with a single message, and it delivers on that message quite effectively. This is an example of a short form game that was designed as a serious game, but not as an educational game per se. As a result, there is no teacher support at all, and since the game was not designed to be an educational game, the lack of teacher support should not impact the game's overall rating. If we rate the

Fig. 7.3 September 12, image © Gonzalo Frasca, 2003–2016

game and count the teacher support as missing, we get quite a different result than if we count the teacher support as not applicable (N/A). The overall rating for this game if teacher support is counted as missing is only 3.4; but, if we classify the teacher support as not applicable, it is 4.2.

7.2.1.2 Game Overview

Content and *Originality*: [5/5] This game distills the essence of a shooter while focusing on a single message.

Game Mechanics: [4/5] Given that they are exceedingly simple, the controls are quite intuitive.

Game Progression: [0/5] N/A There is only one level in this game.

Artistic Design: [4/5] The use of a cartoonish style helps to buffer the message. It is clear it is a game.

Set, *Settings*, *Characters* and *Costumes*: [5/5] Seems ideal for the purpose of the game. It is large enough to support some exploration but not so large so as to imply that there is more to the game than there really is.

Audio: [5/5] There is no music—only the sound of the people, the missile, and the explosion (Fig. 7.3).

7.2.2 *Educational Review*

7.2.2.1 Teacher Support

There is no teacher support at all in this game.

7.2.2.2 Educational Content

Instructional Strategies: [5/5] This game is meant to deliver a message and to promote thought and discussion. Given that, the strategy of letting the player experience an enactment of the message itself would seem to be appropriate.

Instructional Design [3/5]

Problem: Pass—As far as possible given the game
Activation: Pass—The setting and title are likely to prompt recall.
Demonstration: Fail—This is not done explicitly.
Application: Pass—The player is supposed to try things to see what happens.
Integration: Fail—This part needs to be handled by the teacher.

Objectives: [5/5] It provides a simplistic but clear message.

Integration: [2/5] While it is possible to play this game without learning anything, it serves a similar kind of role as that of an image. It relies on external reflection for the impact.

Accuracy: [3/5] Given that there is a clear intended message, the accuracy of the game is contrived to underline that. There is no real accuracy. Whether or not this scenario accurately depicts the real world is subject to debate. That's kind of the point of the game.

Assessment: [3/5] It's appropriate for the game—there is no numeric score. The "score" can be measured by the devastation of the village and the relative proportion of terrorists to civilians.

7.2.2.3 Magic Bullet Assessment

Overall Balance: [5/5] This game is very well balanced given its stated objective.

Can vs. *Must*: [4/5] This game has no end, so in a sense there is nothing the player must learn. If they want to play though, they will need to learn how, and if they want to understand the message, they will have to notice that it is not possible to fire the missile without incurring collateral damage, and without creating new terrorists. If the player waits long enough without shooting, the buildings get rebuilt and some of the terrorists turn back into civilians.

Operational vs. *Educational*: [5/5] The game is very intuitive.

Educational vs. *Discretionary*: [5/5] The message is there, but even if one agrees with the message, it can be fun to play to see how many terrorists can be created (Fig. 7.4).

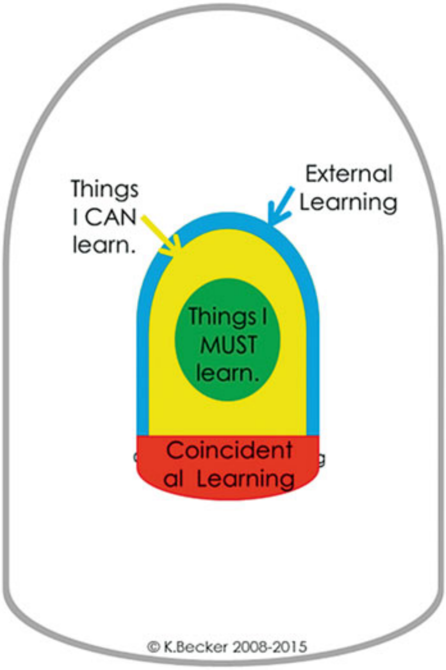


Fig. 7.4 Magic bullet visualization of September 12

This is a thin game. It is meant to be played for just a few minutes and was designed to deliver a single straight-forward concept. Given that it is best suited for teaching a single concept.

7.2.2.4 Instructional Strategies

Learning Theories: Schemata, Situated Learning, Social Constructivism, Experiential Learning

Instructional Strategy: Situated Learning, Discovery Learning, Activity Theory

Situated and discovery learning are among the most common approaches used for learning in games, whether the approach is deliberate or coincidental. This game could also be viewed through the lens of Activity Theory because there is a clear and straight-forward interrelationship between the missile, civilians, terrorists, village, and the rules of the game (Fig. 7.5).

7.2.2.5 Possible Uses and Affordances

September 12 could be very useful as an opening activity before a discussion on the topic of approaches to terrorism and other threats. Students would be allowed to play the game for about 5 min with little or no initial explanation or coaching. Then

Fig. 7.5 Osy osmosis start screen © Copyright IS3D, LLC (Cogent Education)

the lesson would start by discussing what they had experienced and their thoughts about it. Finally, they could again be allowed to play the game for a few minutes at the end of the class. This is not a game that could be used as a stand-alone lesson.

7.3 Osy Osmosis

Osy Osmosis is an educational game released in 2012 and meant to be played either online or on a mobile device. The intent of the game is to help learners understand the process of osmosis by playing the part of a single-celled organism with a permeable membrane who must navigate through a liquid that contains a variety of solutes.

Publisher: IS3D
Developer: IS3D
Release Date: 2012
Genre: Quest
Perspective: Top-Down
Audience: All
Subject: Science: Osmosis
Grade(s): Any
Platform: PC, Mobile
Cost/License: $4.00 (mobile in 2014)

Table 7.2 4PEG summary of Osy Osmosis

Overall rating				**FAIR**: **2.5**	**49**	**/100**	
Summaries							
Game overview	**4.2**	25	/30	**Educational overview**	**1.7**	24	/70
Gameplay	**3.7**	11	/15	Teacher support	**0.3**	13	/20
Art and audio	**4.7**	14	/15	Educational content	**2.2**	13	/30
				Magic bullet rating	**2.5**	10	/20
Game overview	**4.2**	25	/30	**Educational content**	**2.2**	13	/30
Content and originality		4	/5	Instructional strategies		3	/5
Game mechanics		3	/5	Instructional design		2	/5
Game progression		4	/5	Objectives		2	/5
Artistic design		5	/5	Integration		2	/5
Setting and characters		5	/5	Accuracy		4	/5
Audio		4	/5	Assessment		0	/5
Teacher support	**0**	1	/20	**Magic bullet rating**	**2.5**	10	/20
Guides		1	/5	Overall balance		3	/5
Plug N' play		0	/5	Can learn vs. must learn		1	/5
Resources		0	/5	Operational vs. educational learning		4	/5
Community		0	/5	Educational vs. discretionary learning		2	/5

7.3.1 Game Description

"Osy Osmosis is a fun game for all ages where you must help Osy stay safe as she navigates through her world collecting stars. Using your finger, tap in the direction you want Osy to move, but be careful, as you progress, more dangers will present themselves. To help Osy, you will use osmosis to keep her in balance with the world around her" (Jackson et al., 2012) (Table 7.2)

7.3.1.1 Summary Review

This game is visually very appealing and kind of fun to play. It will not help people understand osmosis on their own. They will need the help of someone to explain how what players see and do in the game relates to the processes of osmosis. Osy is an example of a game that has fallen into the decorative media trap. It does have more to offer than visual appearance in that the concepts it seeks to teach are reflected in the behaviors of the objects in the game, but they are not as obvious as they could be.

7.3.1.2 Game Overview

Content and *Originality*: [4/5] Overall it's a pretty game.

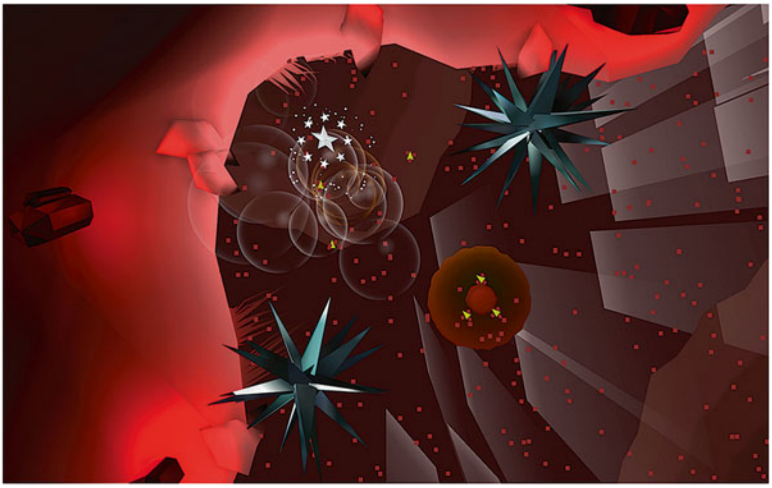


Fig. 7.6 Osy osmosis © Copyright IS3D, LLC (Cogent Education)

Game Mechanics: [3/5] Controls are simple and easy to remember. Reaction is slow on both devices—speed is constant so there is no way to speed up or slow down. There are “bits” and “stars”—no obvious explanation is given for what they mean. I can add and subtract bits—I have no idea why. Sometimes, my bubble shrinks and grows; sometimes it gets red—at level 2, I have no idea what’s going on. The “bits” which are supposed to tell me where the next star is are small and it is sometimes very difficult to see where they are pointing. Going “full-screen” helps, but I have a big monitor so it’s not clear this will always help. There are also black dots whose purpose and function is unclear. Clicking on them tells me nothing. I get advice to add or remove bits, but I’m not told why. Eventually, I’m told that Osy will die if she gets too big or too small—still not telling me what the connection is though. There is presumably a relationship between the black dots and Osy growing and shrinking, but (1) the dots are difficult to see making the reaction appear random, and (2) there is a lag between adding/subtracting bits and growing/shrinking Osy—it is easy to overshoot and end up dying a lot.

Game Progression: [4/5] The stated goal is to: “help Osy stay safe as she navigates through her world collecting stars.” I guess the goal is to collect stars. Rather contrived. It really has nothing to do with osmosis.

Artistic Design: [5/5] Very pleasant looking. Everything hangs together thematically.

Set, *Settings*, *Characters* and *Costumes*: [5/5] The character is cute, and the scenes are nice, if not obvious.

Audio: [4/5] Sound effects are cute. Score is appropriate—not irritating (Fig. 7.6).

7.3.2 Educational Review

7.3.2.1 Teacher Support

Teacher's guide: [1/5] "I was unable to locate this easily. If it's not fairly easy to locate, it might as well not be there. Very brief with promise of more to come. Note: this is unchanged from the last review completed nearly 3 years ago."

Plug and Play: [0/5] Missing

Supplementary Resources: [0/5] Missing

Community: [0/5] Missing

7.3.2.2 Educational Content

Instructional Strategies: [2/5] This game uses discovery as a strategy. Osmosis isn't entirely an intuitive concept so relying primarily on discovery may not be as successful as the designers hope.

Instructional Design: [2/5]

Problem: Pass—The setting is fairly close in kind to a real situation.

Activation: Fail—There really isn't anything in the game that prompts players to call on previous science knowledge.

Demonstration: Fail—There is a minimal amount of tutoring, but it is largely focused on operational learning, so the connection between the gameplay and the intended learning isn't clear.

Application: Pass—The learning that does happen in the game is applied and practiced as the game progresses.

Integration: Fail—Even if the player does learn about osmosis from this game, there is nothing in the game that connects that to anything in real life.

Objectives: [2/5] I already know about osmosis so I am able to make the connections between what's happening on the screen and what my strategy ought to be, but the connections are not at all clear if the player doesn't already know what osmosis is. This implies to me they are unlikely to figure it out from this game.

Integration: [2/5] It is not clear to me that players need to learn anything about osmosis in order to get through the game. They can simply learn the game's requirements without ever associating that with processes in osmosis. This could very likely be mitigated through teacher intervention, but the teacher support that would help make that work is missing.

Accuracy: [5/5] The action in the game does a pretty good job of mimicking what happens in osmosis. Since it is not really trying to be a simulation of the process, this is close enough.

Assessment: [0/5] I can see no way to associate scoring or progression in the game with achieving the learning objectives.

7.3.2.3 Magic Bullet Assessment

Overall Balance: [3/5]
Can vs. *Must*: [1/5]
Operational vs. *Educational*: [4/5]
Educational vs. *Discretionary*: [2/5]

The game is pretty, cute, and kind of fun, except for the difficulty seeing the direction of the bits and the black dots, but those could easily be fixed by changing their size and color. However, players are unlikely to discover any the principles of osmosis from this game. The design is relatively sound, in that the behavior of the game fits the principles of osmosis. There even seem to be different densities of liquids—I say "seem" because I am extrapolating based on seeing slightly different colored clouds and the fact that the speed with which Osy grows and shrinks changes depending on whether she is over dark background or one of the lighter clouds. The problem is that this connection is never made explicit so this discovery effectively works backwards: if you already know about osmosis, you will probably be able to figure out what the various game elements represent. Unfortunately, if the player does NOT already know these things, the behavior of the game elements is unlikely to lead them to these insights.

Insufficient Internal Scaffolding: "Need outside help/resources to get the intended message design does not provide scaffolding" (Fig. 7.7)

7.3.2.4 Instructional Strategies

Learning Theories: Schemata; Situated Learning; Experiential

One of the chief benefits of this game is its ability to help players form a mental model of the process of osmosis. The learning happens as part of the regular game-play and so is both situated and experiential.

Instructional Strategy: Problem Based Learning and Discovery Learning

As it is a kind of treasure hunt where Osy tries to collect stars and avoid obstacles, it could be considered problem based learning. The primary strategy seems to be discovery learning as there is minimal guided practice.

7.3.2.5 Possible Uses and Affordances

Even though *Osy Osmosis* did not score especially well, I think this game could still be quite useful given sufficient assistance by the teacher during play. In this case the teacher would have to take on various roles, including those of instructor, playmaker and guide. The debriefing process will be crucial in helping students make sense of their experiences. It may also be worthwhile to have students play for a short time, then discuss what they are seeing in the game and then allow them to play the game again with new insights.

Fig. 7.7 Magic bullet visualization of Osy Osmosis

7.4 Real Lives

Real Lives is an educational game that was designed to be played in the classroom, although it could be played elsewhere as well. It was designed to let players see what life might be like for people in other countries. It is a game that has no actual win state since the idea is that one plays until their character dies. It is an excellent example of what can be done without having to resort to fancy graphics and animations (Fig. 7.8).

Publisher: Educational Simulations
Developer: Bob Runyan
Release Date: July 31 2009
Genre: Simulation
Perspective: Plain
Audience: All Ages
Subject: Social Studies
Grade(s): 4 and Up
Platform: Computer
Cost/License: $29 (2015) multiple copy pricing available

Fig. 7.8 RealLives splash screen, image © Neeh Solutions

7.4.1 Game Description

Real Lives simulates the life of one person using values and probabilities based on real statistics. When you start the game you are assigned an identity that is chosen using global statistics. As a result, the chances of being born a middle class Canadian, for example are extremely slim. It is a turn-based game where you can make various choices about such things as whether or not to go to school or how to spend the money you have, and then the game advances your life by 1 year and you get to see how things have changed (Table 7.3).

7.4.1.1 Summary Review

Even though this is not a very interactive game, it serves as an excellent vehicle for showing students about social situations in different parts of the world and provides the raw material for other activities that can be done both before and after playing the game.

Table 7.3 4PEG summary of Real Lives

Overall rating				**GOOD [4]**	**4.3**	**85/100**	
Summaries							
Game overview	**4.2**	25	/30	**Educational overview**	**4.3**	60	/70
Gameplay	**4.3**	13	/15	Teacher support	**4.8**	19	/20
Art and audio	**4.0**	12	/15	Educational content	**4.3**	26	/30
				Magic bullet rating	**4.0**	16	/20
Game overview	**4.2**	25	/30	**Educational content**	**4.3**	26	/30
Content and originality		5	/5	Instructional strategies		5	/5
Game mechanics		4	/5	Instructional design		4	/5
Game progression		4	/5	Objectives		5	/5
Artistic design		4	/5	Integration		3	/5
Setting and characters		5	/5	Accuracy		5	/5
Audio		3	/5	Assessment		4	/5
Teacher support	**4.5**	18	/20	**Magic bullet rating**	**4**	16	/20
Guides		5	/5	Overall balance		4	/5
Plug N' play		5	/5	Can learn vs. must learn		3	/5
Resources		5	/5	Operational vs. educational learning		5	/5
Community		3	/5	Educational vs. discretionary learning		4	/5

7.4.1.2 Game Overview

Content and *Originality*: [5/5] This is a unique game in that it uses actual global statistics to determine what happens to the player and the player's family throughout one lifetime.

Game Mechanics: [4/5] Much of the game involves advancing another year and seeing what has happened to you and your family. There are points long the way where you can make various choices, such as what to do with your leisure time and whether or not to become romantically involved with someone you have met.

Game Progression: [4/5] This game does not have levels. Each game follows the life of one individual and their family from that individual's birth to their death.

Artistic Design: [4/5] The interface is clean and intuitive. There is almost no animation.

Set, *Settings*, *Characters* and *Costumes*: [5/5] The setting and characters are determined by a statistical probability. This is unique and very appropriate for the intent of the game.

Audio: [3/5] There are a few sound effects, but not much audio. The game could easily be played with no audio at all, which is not necessarily bad (Fig. 7.9).

Fig. 7.9 RealLives game screen, image © Neeh Solutions

7.4.2 *Educational Review*

7.4.2.1 Teacher Support

Teacher's Guide: [5/5] There is an extensive guide that comes with the purchase of the game.

Plug and Play: [5/5] The teacher support materials are extensive and easy to use.

Supplementary Resources: [5/5] Includes various handouts and other items in the teacher materials.

Community: [3/5] Moderated through epals.com, which is a global education community where teachers and students can connect with each other and share resources and ideas. It includes approximately 200 countries, a million teachers and many more students. It allows teachers to connect with their students and monitor their activity.

7.4.2.2 Educational Content

Instructional Strategies: [5/5] It is a relatively passive game in that players don't really have that much they can do, but it is still engaging to watch the life of your character unfold.

Instructional Design: [4/5] This game is meant to be played in the classroom where each student will be assigned a different character. Given that it is not meant to be a stand-alone game the design is highly appropriate.

Problem: Pass—The game uses actual statistics. Each thing that happens includes information about the statistics for the location of the player's character.

Activation: Pass—Because this is presented as the life of one person, it feels personal.

Demonstration: Pass—Facts are presented and the effects are shown.
Application: Pass—Players are asked to make various choices based on their current situation.
Integration: Fail—Comparisons can be made between the lives lived and the students' lives, but this is done outside of the game.

Objectives: [5/5] The goal is to provide a vehicle for learning about the lives of people around the world. Each life offers a glimpse into the kinds of lives lived ina given country.

Integration: [3/5] It is possible to click through the game without reading anything, but if players do that there is nothing left.

Accuracy: [5/5] It uses global statistics and cites its sources.

Assessment: [4/5] There isn't really a score, but the character has a number of properties that change as a result of what happens to the character and the choices made by the player.

7.4.2.3 Magic Bullet Assessment

Overall Balance: [4/5] There really is very little room to explore in the game but there are many opportunities to expand on what the player is shown. The game includes links to places outside the game where players can get more information.

Can vs. *Must*: [3/5] It is possible to click through the game without reading, but if one does that there is nothing else to do.

Operational vs. *Educational*: [5/5] It is very easy to learn how to use the game so players can get up and running very quickly.

Educational vs. *Discretionary*: [4/5] I wouldn't really describe it as fun, since characters often die young. There are many opportunities to take learning beyond what is presented in the game (Fig. 7.10).

There really is very little room to explore in the game but there are many opportunities to expand on what the player is shown. The game includes links to places outside the game where players can get more information.

7.4.2.4 Instructional Strategies

Learning Theories: Social Learning Theory; Situated Learning

This is very much the case of learning through the lives of others. The characters presented in the game are all fictional, but they represent realistic situations and settings.

Instructional Strategy: Direct Instruction; Spiral Instruction

The game largely follows a direct instruction style where information is presented to the player.

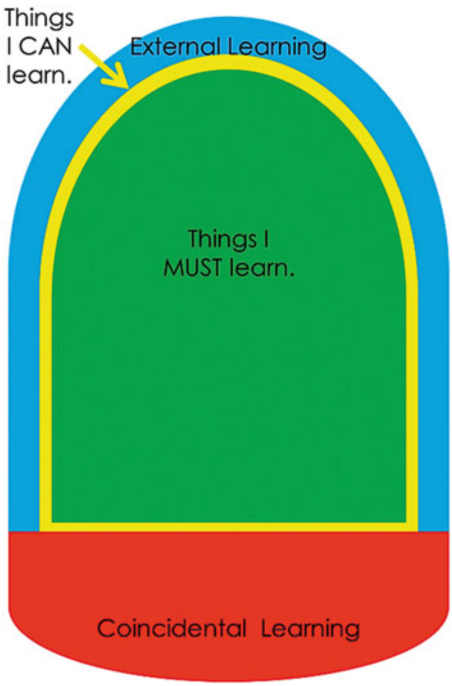


Fig. 7.10 Magic bullet visualization of Real Lives

7.4.2.5 Possible Uses and Affordances

The most obvious use for this game is in the context of a social studies unit, but it could also be used to create character data for stories and also to look at various specific social issues. With the extensive teacher support, it does not really require any special affordances for use. One study that used *Real Lives* with high school students in Northern California showed an increase in global empathy as well as interest in learning about other countries (Bachen, Hernández-Ramos, & Raphael, 2012).

7.5 Math Blaster

Math Blaster is a game with a long history. It was first released in 1983 and started out as a simplistic drill and practice which was wrapped inside a narrative for the second version released in 1987. The narrative is only superficially connected with the learning goals. It has gone through numerous revisions and is now published by the Knowledge Adventure Company as a *freemium* system that includes some activities for free and others that users must pay for with a subscription that can be paid monthly, quarterly, or annually. The game is a side-scrolling platformer that is in some ways similar to the *New Super Mario. Brothers* (*NSMB*). Both games are essentially variations on the traditional obstacle race. Each level consists of a series of obstacle courses where players are to reach the end with a certain time limit while collecting as many treasures as possible and at the same time avoiding various hazards. *NSMB* is a purely commercial title and a member of one of the most popular series of all time. It has very little educational potential, while *Math Blaster* was specifically designed as an educational title for use in the home and in schools. *Math Blaster* is one of the games that is commonly named by teachers and parents as an example of a good educational game, though rarely by the children who are to learn from it. Interestingly, it is also often used by professional game designers as a favorite example of a bad educational game.

Publisher: Knowledge Adventure Company
Release: 1987, 1990, 1993, 1996, 1999, 2006, 2007–2014
Genre: Platformer
Perspective: Full Shot, Eye Level View
Audience: School and Homeschool
Subject: Math
Grade(s): Various
Platform: Web (Unity) Mobile
Cost: iTunes $1.99 (2015); Online freemium
There are various licensing models for teachers and schools.

7.5.1 Game Description

Math Blaster is an educational game that claims to meet curricular requirements in math for a wide variety of grades. The version that was reviewed is the 2015 online version. Although the game has evolved over the years, it is still in many ways the same game that it was in 1987 (Table 7.4).

7.5.1.1 Summary Review

I tried both the iPad App and the online portal. The online version is embedded in a social network environment where players are supposed to connect with other players to send messages and compare their scores. There are a number of variants available. I reviewed the one that deals with basic math skills including addition, subtraction, multiplication, division. The graphics have changed since the 2006 version, but the mechanics are effectively the same. The documentation explains how to install and run the program as well as explaining the controls, but there is nothing about the game or its story. It looks like the game is seen as merely the vehicle for instruction.

Table 7.4 4PEG summary of Math Blaster

Overall rating				**POOR** [1]	**1.4**	**27/100**	
Summaries							
Game overview	**1.5**	9	/30	**Educational overview**	**1.3**	18	/70
Gameplay	**1.7**	5	/15	Teacher support	**0.3**	1	/20
Art and audio	**1.3**	4	/15	Educational content	**2.0**	12	/30
				Magic bullet rating	**1.3**	5	/20
Game overview	**1.5**	9	/30	**Educational content**	**3.5**	21	/30
Content and originality		2	/5	Instructional strategies		2	/5
Game mechanics		1	/5	Instructional design		1	/5
Game progression		2	/5	Objectives		2	/5
Artistic design		2	/5	Integration		1	/5
Setting and characters		1	/5	Accuracy		5	/5
Audio		1	/5	Assessment		1	/5
Teacher support	**0.3**	1	/20	**Magic bullet rating**	**1.3**	5	/20
Guides		1	/5	Overall balance		1	/5
Plug N' play		0	/5	Can learn vs. must learn		2	/5
Resources		0	/5	Operational vs. educational learning		1	/5
Community		0	/5	Educational vs. discretionary learning		1	/5

7.5.1.2 Game Overview

This time instead of running along a path as in the 2006 version, the player flies a spaceship down something that resembles a typical SciFi wormhole. In one game, the player must survive a minute of flying through the wormhole, avoiding obstacles and attempting to catch power shields before making it to the end where they are asked a number of arithmetic questions and given 6–8 options. In another the player appears to be sitting in a spaceship that is passing by various objects with numbers on them. The player is given an equation and must shoot the correct answer. The mini-games are basically variations on real-life amusement park games, but instead of having to hit a target to win a prize, the player must hit the target that has the answer to the equation.

Content and *Originality*: [2/5] There are a dizzying number of activities and places, but only some have to do with learning math. Others appear to be there just for fun or to encourage interaction with other players. It is very much like a traditional amusement park.

Game Mechanics: [1/5] The graphics have changed since the 2006 version, but the mechanics are effectively the same. All of the games tried were either guessing games or multiple choice. Aside from shooting numbers, none of the game mechanics were directly connected with the learning objectives. The platform games were difficult to traverse and as a result the player must make many attempts before getting to any of the math equations.

Game Progression: [2/5] This was not tested in the online and mobile versions because they required additional payments. In the 2006 version, the player is forced to step through a preordered set of levels that is the same for each of the eight possible "fact families."

Artistic Design: [2/5] The animation is somewhat smoother than the 2006 version, and the characters are of somewhat better quality artistically. It has dark colors, often with little contrast, making it difficult to make out at times.

Set, *Settings*, *Characters* and *Costumes*: [1/5] I do not find it especially appealing, but those in K-6 might as it is similar to many other animations and websites targeted at that age-group. There is little originality in that it looks much like many other space-themed games for kids—it is flashy and each screen is very busy.

Audio: [1/5] Audio is appropriate for the space theme, but runs on a very short loop that has in some cases been badly edited so it sounds like it's skipping.

7.5.2 Educational Review

7.5.2.1 Teacher Support

Teacher's Guide: [1/5] The online version has no obvious teacher support. Teachers are supposed to buy PC versions for their students.

Plug and Play: [0/5] The product description on the website says nothing about teacher guides or lesson plans.

Supplementary Resources: [0/5] None available with online or mobile versions.

Community: [0/5] The company website is different from the *Math Blaster* website making it difficult to navigate back and forth. There does not appear to be a freely accessible community for teachers.

7.5.2.2 Educational Content

Instructional Strategies: [2/5] While drill and practice can be very effective for learning basic arithmetic, this game has so much else going on that is unrelated to the math, it is easy to spend that majority of one's time doing things that have nothing to do with the learning goals. Further, so much of the interface that surrounds the drill involves required actions and activities that there is no way to focus on just the learning objects.

Instructional Design: [1/5] This game is effectively a fancy set of worksheets. Presumably learning happens through repetition and practice.

Problem: Fail—Most of the activities are amusement park-style wrapper games that could be used to present anything.
Activation: Fail—None present.
Demonstration: Fail—How to play the game is demonstrated, but not the math.
Application: Pass—Players are given various equations to answer.
Integration: Fail—This is simply a drill application.

Objectives: [2/5] Assuming that the player does not rely on guessing, which is possible, then the drill and practice will probably yield the desired results, namely, to learn basic math facts.

Integration: [1/5] With few exceptions, such as a dial that asks you to guess the angle shown, this game could be used to teach almost anything. It is a wrapper for work-sheet style questions. It IS in fact possible to get through this game without being able to do much more than guess and count, so it passes the BLT.

Accuracy: [5/5] As far as it goes, the math appears to be correct.

Assessment: [1/5] Players do get points for correct answers but far too much of each *mini-game* depends on things that are completely unrelated to the learning objectives.

7.5.2.3 Magic Bullet Assessment

Overall Balance: [1/5] It is interesting to note that the balance has changed quite dramatically in the current version from the 2006 version.

Can vs. *Must*: [2/5] The 2006 version had little that players could do that was not required. In the 2015 online version there are many different things that are not required, but the activities directly related to the learning goals have not really changed. The 2006 version suffered from an impoverished environment, and the 2015 version is too busy.

Operational vs. *Educational*: [1/5] There is far too much that players have to do before they can get to any of the required learning and then once they get there it turns out to be worksheet questions.

Educational vs. *Discretionary*: [1/5] No. The 2006 edition of this game had too little that was discretionary, and the current version has far too much. There are many things players can do that have nothing to do with the learning goals, but there is little else to foster further learning (Fig. 7.11).

7.5.2.4 Instructional Strategies

Learning Theories: Operant Conditioning through repetition and reward. As is typical of drill exercises, participants are expected to repeat these exercises many times.

Instructional Strategy: Programmed Instruction

Drill and practice is a variant of Programmed Instruction, albeit a simplistic one. Participants are closely guided through a set of activities over with they have little control.

7.5.2.5 Possible Uses and Affordances

Math Blaster ended up with a score of only 1.4. I have said that the score is not necessarily like a grade, but a very low score does indicate that many elements are either poorly done or missing entirely. I would not use this game at all, as there is far too much that players are required to do that does not help them achieve their educational goals, and most of the games depend more on skills totally unrelated to math than they do on the actual math skills.

Fig. 7.11 Magic bullet visualization of Math Blaster

7.6 Gone Home

Gone Home is an independently developed and produced game that contains no conflict, or violence, or even any other characters. The story is compelling and draws the player in with haunting music and an old-fashioned mystery. It should be noted that this particular game has very little in the way of inherent educational potential, but rather it is a game that can be studied in much the same way as a novel. The review that follows reflects the game's potential as a literary object (Fig. 7.12).

Publisher: Fullbright Company LLC
Developer: Fullbright Company LLC
Release Date: August 15 2013
Genre: Story-Based Mystery
Perspective: First Person
Audience: Young Adult to Adult
Subject: English (Literature)
Grade(s): High School
Platform: Computer
Cost/License: $19.99 (2015)

Fig. 7.12 Gone home start screen Gone Home is © The Fullbright Company, 2013–2016

7.6.1 Game Description

Gone Home is a mystery game that is played entirely inside a single house. You play as a 20 year old woman named Kaitlin who arrives home after a trip to Europe. The game starts with Kaitlin on the porch where she can see a note on the door from her sister Sam. The house is empty but we are free to explore its entirety and examine almost all items. There are a few places that are locked and must be unlocked using clues found elsewhere, but most of the gameplay is nonlinear in that players are free to explore anything they want in any order. There is an audio diary that's been left by Sam and certain items trigger entries that you can hear. The game ends when you discover when has happened to your parents and sister (Table 7.5).

7.6.1.1 Summary Review

This was not designed as an educational game yet there are not very many educational perspectives that could be pursued. However it has potential as a story and has been used as the subject of literary study. Used in this way it has considerable potential if studied in much the same way as literature, which is why it is included here.

7.6.1.2 Game Overview

Content and *Originality*: [5/5] This game has won numerous awards for its narrative and story.

Table 7.5 4PEG summary of Gone Home

Overall rating				**GOOD** [4]	**3.7**	**74**	
Summaries							
Game overview	**5.0**	30	/30	**Educational overview**	**3.1**	44	/70
Gameplay	**5.0**	15	/15	Teacher support	**0.0**	0	/20
Art and audio	**5.0**	15	/15	Educational content	**4.0**	24	/30
				Magic bullet rating	**5.0**	20	/20
Game overview	**5.0**	30	/30	**Educational content**	**4**	24	/30
Content and originality		5	/5	Instructional strategies		5	/5
Game mechanics		5	/5	Instructional design		5	/5
Game progression		5	/5	Objectives		4	/5
Artistic design		5	/5	Integration		5	/5
Setting and characters		5	/5	Accuracy		5	/5
Audio		5	/5	Assessment		0	/5
Teacher support	**0.0**	0	/20	**Magic bullet rating**	**5**	20	/20
Guides		0	/5	Overall balance		5	/5
Plug N' play		0	/5	Can learn vs. must learn		5	/5
Resources		0	/5	Operational vs. educational learning		5	/5
Community		0	/5	Educational vs. discretionary learning		5	/5

Game Mechanics: [5/5] You can explore the entire house: open drawers and cupboards, read papers you find, turn on lights and operate appliances. Only some actually help you progress through the game.

Game Progression: [5/5] This game does not have traditional levels but instead grants access to additional parts of the house as you explore.

Artistic Design [5/5] It is quite dark, but the game takes place at night during a thunderstorm so it is appropriate.

Set, *Settings*, *Characters* and *Costumes*: [5/5] The entire story hangs together extremely well.

Audio: [5/5] The audio also fits with the theme of the game and is interesting and enjoyable (Fig. 7.13).

7.6.2 Educational Review

7.6.2.1 Teacher Support

Teacher's Guide: [0/5] Missing

Plug and Play: [0/5] Missing

Supplementary Resources: [0/5] Missing

Community: [0/5] Missing

Given that the game was never designed to be used in an educational context, it shouldn't be surprising that it lacks teacher support. Here this is marked as "n/a" for the same reasons that teacher support is not expected with most novels that are studied in

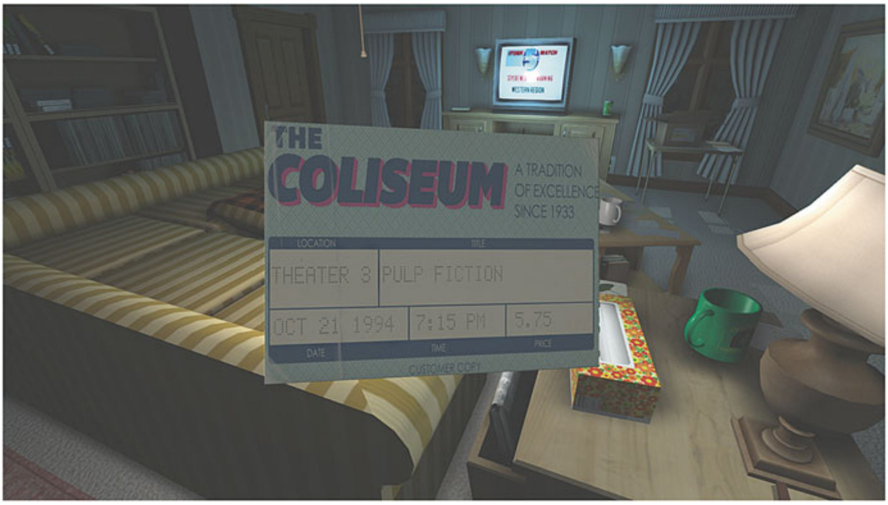


Fig. 7.13 Movie ticket, Gone Home is © The Fullbright Company, 2013–2016

school. The novel, To Kill A Mockingbird (Lee, 1960) was also not produced with teacher support since it was not originally written as an educational novel, but over time it has been used often enough that outside sources of teacher support now exist. This may happen here too. For now, it is noted as being missing, but because it was not originally designed as a serious game, it does not figure into the overall score.

7.6.2.2 Educational Content

Instructional Strategies: [5/5] This entire game is based on exploration and discovery.

Instructional Design: [5/5] It does not lead us through but instead allows us to explore at will.

Problem: Pass—The story setting is definitely a real-world setting and the mystery is one that engages us right at the start of the game.
Activation: Pass—There are many items in the game that we can manipulate and read. Many of them assume some prior knowledge.
Demonstration: Pass—There are minimal hints in the game but they are clear and consistent.
Application: Pass—Some of the mysteries in the game are resolved by putting together various other bits of information we have found.
Integration: Pass—It is unlikely anyone will learn anything practical from the items in the house, but the narrative certainly has real-world applications.

Objectives: [4/5] If the objective is to provide a rich story that has potential for examination as an unfolding mystery, then it meets its objectives.

Integration: [5/5] It fails the Becker Lazy Test as it is not possible to get to the end of the game without exploring enough of the house to solve the mystery.

Accuracy: [5/5] Given that it is a work of fiction set in 1995, the items in the house are all appropriate.

Assessment: [0/5] There really isn't any direct scoring.

7.6.2.3 Magic Bullet Assessment

Overall Balance: [5/5] This game has a good balance of all kinds of learning.

Can vs. *Must*: [5/5] There are no educational objectives, but it is not possible to get through the game by random chance.

Operational vs. *Educational*: [5/5] The game's controls are simple and quite easy to learn.

Educational vs. *Discretionary*: [5/5] There are many things to explore that don't have anything directly to do with the mystery to be solved (Fig. 7.14).

7.6.2.4 Instructional Strategies

Learning Theories: Situated Learning; Discovery Learning; Experiential Learning

It is easy to identify with Kaitlin in the game. If we had come home after a long trip to find our parents' house empty we would likely go exploring much like we can in the game.

Instructional Strategy: Problem-Based and Discovery Learning

The game begins with a mystery and the approach is an unguided exploration.

7.6.2.5 Possible Uses and *Affordances*

As was mentioned at the start of this game's review, *Gone Home* makes for a compelling and interesting story. The game itself does not really teach us anything, although the story does, and it has many possibilities, both from the perspective of the story it tells and how it tells it. This game is an example of how the medium of the videogame can be used as a work of fiction, and it can be studied for its narrative. It opens up interesting possibilities for new ways to experience and study narrative. It can be played in about 3 h, and the fact that it also includes a variety of historically situated documents allows for a variety of approaches to its study as well. Paul Darvasi has been using it in his high school English classes and has written extensively about it on his blog called ludiclearning.org (Darvasi, 2014).

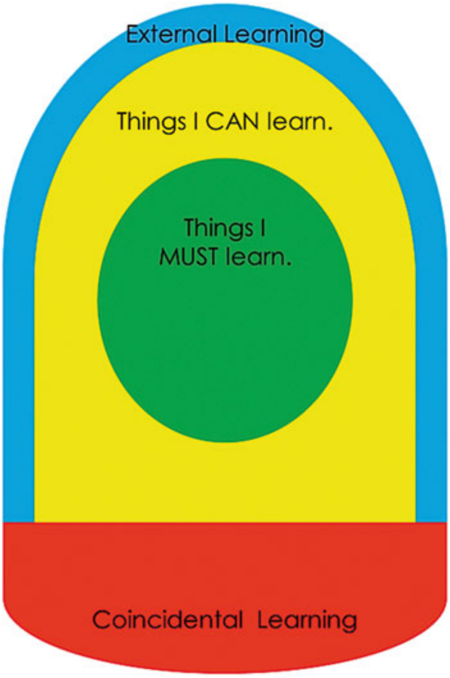


Fig. 7.14 Magic bullet visualization of Gone Home

7.7 Minecraft

Minecraft is an open world game where players need not pursue any specific goals but where they can build their landscape and objects using building blocks sort of like Lego. Like the previous game (Gone Home), *Minecraft* began as an award-winning independent entertainment game, only *Minecraft* is a multiplayer online game while Gone Home is decidedly single player. The commercial version still exists and is kind of like a cross between Lego and *World of Warcraft*. The world is made up of blocks of various sorts and even the people and weapons look like they are made of blocks. In the online game, players can go on quests and defeat monsters, but they can also build things. Blocks are easily created and destroyed which tends to encourage constant tinkering. It is reported that nearly 20 million people have downloaded the commercial version of *Minecraft* (Persson, 2015). In 2012, Mojang developed minecraftedu and created a version of *Minecraft* with an optional narrative that could be used in educational settings (Fig. 7.15).

Publisher: Mojang AB
Developer: Mojang AB
Release Date: Jun 29, 2011
Genre: Simulation
Perspective: First-Person Perspective
Audience: Everyone

Fig. 7.15 Minecraft image courtesy of TeacherGaming LLC

Subject: Various
Grade(s): Any
Platform: Browser/Mobile
Cost/License: $18 single user; $41/server

7.7.1 Game Description

"Minecraft is a game about breaking and placing blocks" (Persson, 2015). The educational version has retained the basic functionality but added extensive teacher controls, such as whether or not to allow students to build, or play in *PvP* mode, leaving us with an open sandbox version of the original game suitable for use in classroom settings (Table 7.6).

7.7.1.1 Summary Review

This game is an excellent example of a sandbox environment where players can build whatever they, or whatever the teacher has asked of them. Students are free to experiment and be creative, either collaboratively or individually. The teacher has control over many features of the game making class management a realistic option in this expansive world.

Table 7.6 4PEG summary of Minecraft

Overall rating				**EXCELLENT [5]**	**4.5**	**90**	
Summaries							
Game overview	**5.0**	30	/30	**Educational overview**	**4.3**	60	/70
Gameplay	**5.0**	15	/15	Teacher support	**5.0**	20	/20
Art and audio	**5.0**	15	/15	Educational content	**3.3**	20	/30
				Magic bullet rating	**5.0**	20	/20
Game overview	**5.0**	30	/30	**Educational content**	**3.3**	20	/30
Content and originality		5	/5	Instructional strategies		5	/5
Game mechanics		5	/5	Instructional design		5	/5
Game progression		5	/5	Objectives		5	/5
Artistic design		5	/5	Integration		0	/5
Setting and characters		5	/5	Accuracy		5	/5
Audio		5	/5	Assessment		0	/5
Teacher support	**5.0**	20	/20	**Magic bullet rating**	**5**	20	/20
Guides		5	/5	Overall balance		5	/5
Plug N' play		5	/5	Can learn vs. must learn		5	/5
Resources		5	/5	Operational vs. educational learning		5	/5
Community		5	/5	Educational vs. discretionary learning		5	/5

7.7.1.2 Game Overview

Content and *Originality*: [5/5] World building games are not new, but this is the first one that uses Lego-like blocks.

Game Mechanics: [5/5] You can do almost anything in the educational version that you can do in the commercial version except hurt each other and die. The point is to provide a place where students can build things.

Game Progression: [5/5] There aren't really levels in this game. Has various controls that the teacher can use to watch students or moderate behavior.

Artistic Design: [5/5] It's kind of quirky. The blockiness gives it a child's toy quality that many find appealing (Fig. 7.16).

Set, *Settings*, *Characters* and *Costumes*: [5/5] Everything is in the same style—even the sun is square.

Audio: [5/5] The sound effects are good, and the music interesting.

7.7.2 Educational Review

7.7.2.1 Teacher Support

Teacher's guide: [5/5] "It is possible to access everything you need to get started at the Minecraftedu.com website. It includes a learning management utility where teachers can create assignments and give them to their students. It has many of the tools that a course management system has."

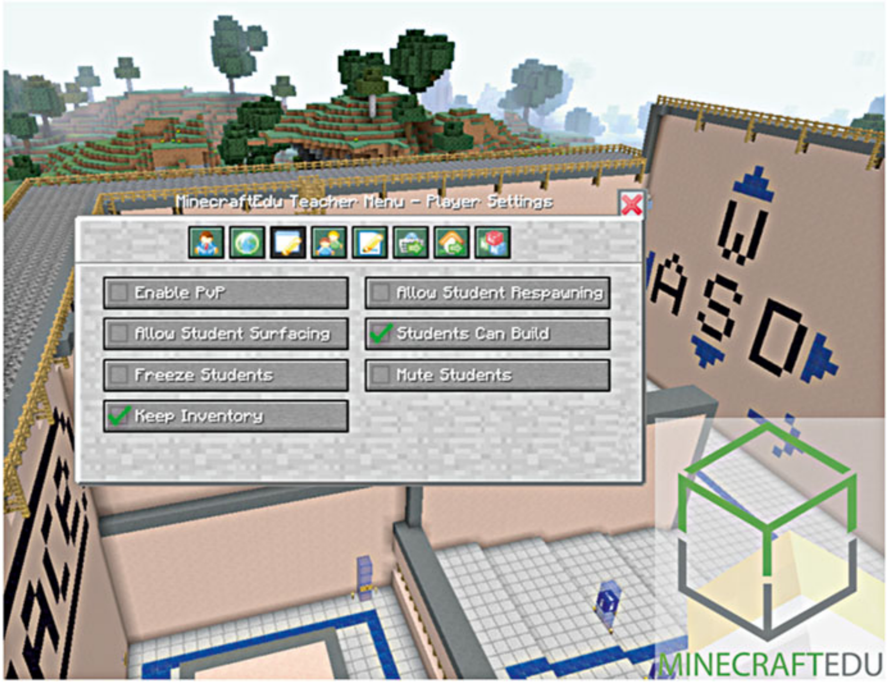


Fig. 7.16 Minecraft image, image © TeacherGaming LLC

Plug and Play: [5/5] There are a growing number of lesson plans as well as downloadable pre-built worlds in the Minecraftedu Libraries, such as lessons to teach programming, building historical structures, conduct archaeological digs, and even build chemical structures.

Supplementary Resources: [5/5] There are many how-to videos as well as walk-throughs, and wikis to which teachers can turn for help, ideas, and more information.

Community: [5/5] There is an extensive and growing community for teachers who use Minecraft.

7.7.2.2 Educational Content

Instructional Strategies: [5/5] The basic strategy is to let learners build things. Beyond that, the sandbox

Instructional Design: [5/5]

Problem: Pass—There are unlimited possibilities for creating problems to be solved.
Activation: Pass—Learners are able to bring past experiences to bear on the construction projects possible in this game.

Demonstration: Pass—There is an extensive tutorial space where demonstrations can be set up.
Application: Pass—The game is designed to promote application of ideas.
Integration: Pass—Although the world is not especially realistic, there are many ideas and principles that can be embodied using the tools in this game.

Objectives: [5/5] It provides all the raw materials needed to allow for the design of sound instruction using this game.

Integration: [0/5] Given that the intent was never to teach anything specific in this game, the controls are easy to use. It allows teachers to build whatever lesson they choose.

Accuracy: [5/5] This aspect is really up to the instructional design of the lessons using this game. Insofar as the integrity of the dimensions of the blocks and the properties of the building materials, it is accurate. It does not adhere to the laws of physics, but that is not the point of this game. There are other controls like desertification and tropification that do match with various curricula and are accurate.

Assessment: [0/5] There is no scoring

7.7.2.3 Magic Bullet Assessment

Overall Balance: [5/5] This game has little that is actually required which is highly appropriate for a sandbox style game.

Can vs. *Must*: [5/5] The educational version doesn't really have an end but players will need to learn how to build within the game if they wish to do something other than wander about. As was said before, the educational objectives are meant to be defined by the teacher so whether or not it is possible to get through without learning is up to the person who designs the instruction.

Operational vs. *Educational*: [5/5] There is a certain amount of operational learning that is required (more for the teacher/administrator than for the students), but given that this is the kind of game that could be used for multiple lessons and even across disciplines, the amount is appropriate.

Educational vs. *Discretionary*: [5/5] There is a highly appropriate balance between discretionary and educational learning. Again, this is under the control of the teachers but there is plenty of room for learners to fool around—to the point where teachers may find they have to mute their students so they can talk to them or teleport all of their students back to the start (Fig. 7.17).

7.7.2.4 Instructional Strategies

Learning Theories: Social Constructivism, Discovery Learning, Constructionism

While the built-in learning theoretical underpinnings are constructionism and discovery learning, teachers can build lessons that support almost all of the other theories. Learners can play individually but it is designed to allow for classes to play together, so social learning theories can also be significant here.

Instructional Strategy: Constructivist Learning Environments

As in the last section the fact that it is an open worked where teachers can enact whatever lessons they choose. If I had to pin it down to a single one, I would say this is very much a constructivist learning environment as Jonassen envisioned.

7.7.2.5 Possible Uses and Affordances

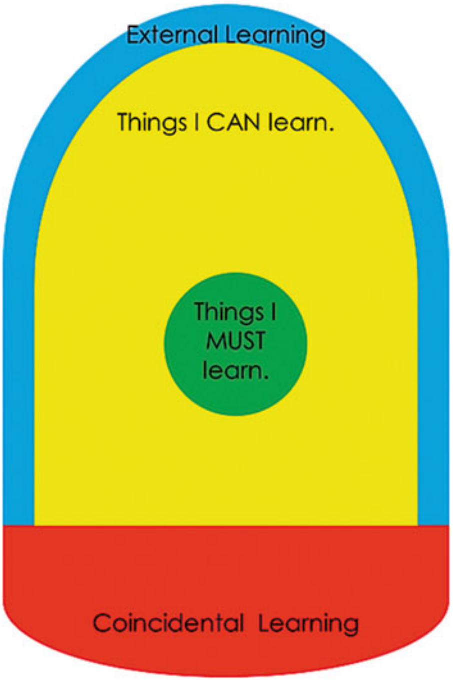
Minecraft is starting to be used more frequently as an environment for learning in art (Overby & Jones, 2015) geography (Scarlett, 2015). While the applications in counting, measurement, and geometry are fairly obvious, Minecraft has other uses as well. One group used it as a space where Masters of Education students, all of who were experiences teachers, created math games inside of the Minecraft environment (Bos, 2015), and still another used it as a place where learners' knowledge-making dialogues could be elicited, captured, and analyzed (Wernholm & Vigmo, 2015).

7.8 Portal 2

The original *Portal* is a first person puzzle game released in conjunction with *Half-Life 2* in 2007. Its most remarkable feature was a unique mechanic that allowed the main character to create a connection between two places that are not otherwise physically connected. Using a portal gun, the player can open a portal on a surface somewhere in the game and then open a second portal on another surface which connects the two surfaces together. The player can then send any object, including themselves and lasers, into one of the openings and whatever is sent through the portal immediately comes out the other opening at the same speed and trajectory as it had going in. The game became very popular and people wanted more puzzles, and although they had released their authoring tool it was very complex and most people found it was not user-friendly enough to allow them to create their own puzzles. In response, the Valve Corporation built a stand-alone puzzle maker using the same engine that had been used for the original game, and this became the basis for the Portal 2 educational version.

Publisher: Valve Corporation
Developer: Valve Corporation
Release Date: 2012
Genre: Action Puzzle
Perspective: First Person
Audience: 10+
Subject: Math and Physics
Grade(s): 4+
Platform: Computer
Cost/License: Free

Fig. 7.17 Magic bullet visualization of Minecraft



7.8.1 Game Description

This is an educational version of the original *Portal 2*, which is in turn a sequel to the original Portal. The Puzzle Builder allows players to create their own rooms and populate it any way they choose. In these rooms they have access to all the tools that are available in the original game and this in turn allows players to experiment with time, gravity, momentum, distance, and other physical elements. The interface is very powerful yet easy to use and as a result provides a virtual lab that can be used in a wide variety of ways, some of which are discussed in Chap. 4 (Table 7.7).

7.8.1.1 Summary Review

This game has tremendous potential for use as a virtual lab. It allows users to explore physics in ways that can never be done in real life. It allows them to answer the kinds of What if? questions that can be extremely valuable if surrounded by the right kind of pedagogical support.

Table 7.7 4PEG summary of Portal 2

Overall rating				**EXCELLENT [5]**	**4.8**	**95**	
Summaries							
Game overview	**5.0**	30	/30	**Educational overview**	**4.6**	65	/70
Gameplay	**5.0**	15	/15	Teacher support	**5.0**	20	/20
Art and audio	**5.0**	15	/15	Educational content	**4.2**	25	/30
				Magic bullet rating	**5.0**	20	/20
Game overview	**5.0**	30	/30	**Educational content**	**4.2**	25	/30
Content and originality		5	/5	Instructional strategies		5	/5
Game mechanics		5	/5	Instructional design		5	/5
Game progression		5	/5	Objectives		5	/5
Artistic design		5	/5	Integration		5	/5
Setting and characters		5	/5	Accuracy		5	/5
Audio		5	/5	Assessment		0	/5
Teacher support	**5.0**	20	/20	**Magic bullet rating**	**5**	20	/20
Guides		5	/5	Overall balance		5	/5
Plug N' play		5	/5	Can learn vs. must learn		5	/5
Resources		5	/5	Operational vs. educational learning		5	/5
Community		5	/5	Educational vs. discretionary learning		5	/5

7.8.1.2 Game Overview

Content and *Originality*: [5/5] This is a highly original idea and the fact that the developers have created an educational version using the same approaches to user testing as they use for their commercial titles has resulted in an application that looks completely professional and works seamlessly.

Game Mechanics: [4/5] You can do anything in this game you could do in the original. There are about two dozen different objects, including portals, cubes, robots, deadly goo, and more. The room can be made any shape of size and can be covered in a variety of surfaces.

Game Progression: [0/5] Given the nature of the game, there are no built-in levels, but it is certainly possible to begin with a very simple puzzle and develop it to become very complex.

Artistic Design: [4/5] It uses a realistic style but one that is largely lacking in organic components which is highly appropriate for the game. Most of the game is done in white, black, and grays, making the occasional bits of color stand out prominently.

Set, *Settings*, *Characters* and *Costumes*: [5/5] The original narrative of the game has been left out, leaving only the other objects. No-one who has any experience with either of the original games would have any trouble recognizing this as part of the same universe.

Audio: [5/5] Uses the same audio as in the original game. The sound effects are well done and the music fits the theme of the game.

7.8.2 Educational Review

7.8.2.1 Teacher Support

Teacher's Guide: [5/5] The starting point for guides and other help are supported by the developers at teachwithportals.com. There is a wiki with access to numerous tutorials on how to create with this tool. There is also another site created by former physics teacher Cameron Pittman called Physics with Portals that provides guides, videos, lesson plans, etc.

Plug and Play: [5/5] The LearnWithPortals site includes a growing number of lesson plans contributed by teachers who are using this in their classes.

Supplementary Resources: [5/5] The same site also includes additional resources and there is a growing collection of other resources that are easy to find using Google.

Community: [5/5] The main website has a nonpublic forum that is open to educators.

7.8.2.2 Educational Content

Instructional Strategies: [5/5] There are no specific learning outcomes. Rather the teacher can set objectives for the students—the game then becomes the place where students can build rooms to test and demonstrate.

Instructional Design: [5/5] It meets all of Merrill's principles.

Problem: Pass—Much of the physics within the game is accurate.
Activation: Pass—Users will likely draw on their existing knowledge of physics and math. Some may have experience with the Portal games but it is not necessary.
Demonstration: Pass—Users can create experiments to test out theories and ideas.
Application: Pass—As they learn new techniques they can build new rooms and test them.
Integration: Pass—The physics principles used in this game can be directly applied to real-world problems—except the portal of course!

Objectives: [5/5] It provides all the raw materials needed to allow teachers to create physics lessons.

Integration: [5/5] Given that this is essentially a virtual laboratory, it is very hard to get through the game by pure chance without coming to understand some of the physical principles embodied in the game.

Accuracy: [5/5] Like most games, it is not completely accurate, but it is accurate enough to learn the initial principles. When users become more expert, it is also possible to use the game to compare real physics with what is being simulated in the game.

Assessment: [0/5] There is no actual scoring in the game. That part is left to the educators who create the challenges.

7.8.2.3 Magic Bullet Assessment

Overall Balance: [5/5] This game provides a rich environment where players can create complex puzzles. Most will find they need outside resources to help them with the physics, although learning to use the puzzle builder can be done without extra help.

Can vs. *Must*: [5/5] It really isn't possible to get through the game without learning anything, although the physical laws are not spelled out for players so they may only get those with outside help.

Operational vs. *Educational*: [5/5] The interface is very easy to learn allowing users to get to the business of building puzzle rooms quickly.

Educational vs. *Discretionary*: [5/5] The open nature of the game means that players can create all kinds of fantastical setups just for fun (Fig. 7.18).

7.8.2.4 Instructional Strategies

Learning Theories: Schemata, Constructionism, Experiential Learning

This is a constructionist kind of game where players will develop theories based on what they learn from the puzzles they build.

Instructional Strategy: Problem-Based Learning, Discovery Learning, Activity Theory

Both while puzzles are being designed and built, and when they are being solved this game takes a problem based learning approach combined with discovery learning.

Because of the very close connections between the learner, objects, and tools it would also suggest that activity theory applies.

7.8.2.5 Possible Uses and Affordances

This game has been designed to be used as part of a lesson rather than the entire lesson. Cameron Pittman, the teacher behind physicswithportals.com has used the *Portal 2* puzzle maker as a kind of virtual physics lab with considerable success. "I successfully taught with Portal 2 because I leveraged my intimate knowledge of the Portal universe and real-world physics to ensure that virtual experiences and physical applications complemented one another. In that sense, video games are not standalone educational tools; they are field trips, laboratories, and everyday experiences rolled into one, creating opportunities for students to draw connections and gain deeper understandings" (Pittman, 2013, p. 358). In another case "broken" rooms were set up, and students were asked to fix the rooms to make them playable. Castaneda found that this approach leads to a wide variety of solutions and resulted in different conversations than were normally had when students were asked to build rooms (Castaneda, 2014). This game has tremendous potential, but as Pittman says, it requires a considerable investment on the part of the teacher.

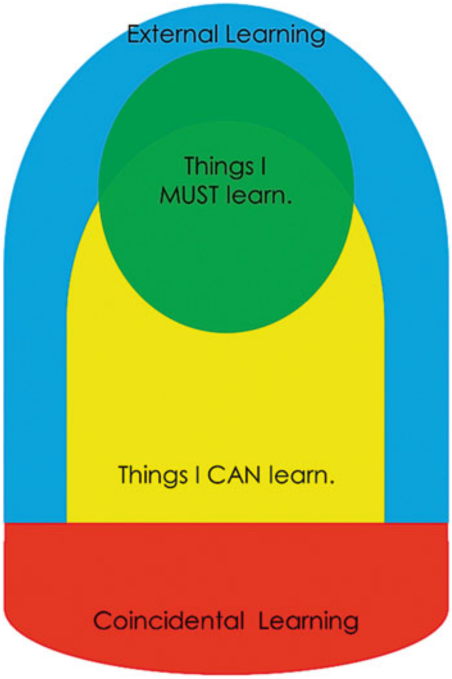


Fig. 7.18 Magic bullet visualization of Portal 2

7.9 Summary

We've looked at seven different games: *September 12* was designed as a serious game, but not an educational one, *Osy Osmosis*, *Math Blaster*, and Real Lives are all educational games, *Gone Home* was designed purely for entertainment purposes, and both *Minecraft* and *Portal 2* were originally designed for entertainment but have been adapted by the developers to meet educational needs. Different reviewers will likely come up with at least somewhat different results, as is the case with most subjective reviews. Some may even disagree radically. One of the challenges with many reviews found on the web is that the reviews tend to be largely unstructured which makes comparing one against the other somewhat difficult. The structure of this model allows us to zero in on the specific parts that differ.

With the possible exception of *Math Blaster*, none of these games would be suitable as stand-alone lessons and they've been assessed with that in mind. Unfortunately because of how it's put together, I would not recommend *Math Blaster* for use at all—with or without guidance. Looking at the results when they are shown side-by-side as in Table 7.8, we can consider the games from each of the four pillars. All but *Math Blaster* were given good scores as games. Three have considerable teacher support (*Real Lives*, *Minecraft*, and *Portal 2*), but the educational content scores are quite varied. The amount of teacher time investment required varies considerably as well. It should stand to reason that a more involved game like *Minecraft* or *Portal 2* would also require a greater time commitment on the part of the teacher to become

Table 7.8 Comparison of games reviewed

Game	Sept 12	Osy Osmosis	Math Blaster	Real Lives	Gone Home	Minecraft	Portal 2
Type	4	1	1	1	3	2	2
Cost	Free	$4.00 (mobile)	freemium	$29 multiple copy pricing available	$19.99/copy	Free	Free
Time to play	5 Min.	<1 h.	Varies	1 h.	3 h.	Varies	Varies
Teacher time investment	<30 Min.	1–2 h.	Minimal	2–4 h.	Same as a novel	Moderate–High	Moderate–High
Stand alone	No	No	Yes	No	No	No	No
Total score	4.2	2.5	1.4	4.3	4.9	5.0	5.0
Game overview	4.6	4.2	1.5	4.2	5.0	5.0	5.0
Educational overview	4.0	1.7	1.3	4.3	4.9	5.0	5.0
Teacher support	0	0	0.3	4.5	0	5.0	5.0
Educational content	3.5	2.2	3.5	4.3	4.8	5.0	5.0
Magic bullet rating	4.8	2.5	1.3	4.0	5.0	5.0	5.0

Game types: (1) Educational game, (2) Educational adaptation of entertainment game, (3) Independent entertainment game, (4) Newsgame

familiar with it. A short form game should require a proportionately smaller time investment from the teacher as well. If it doesn't, then it is reasonable to assume that the game may not be especially useful. Since both *Minecraft* and *Portal 2* are sandbox style games, the amount of time it takes to become familiar enough with the game is bound to be greater than with a more linear experience such as *Real Lives*. In the end the scores combined with the demographic data provide a considerable amount of information that teachers can use to decide whether or not a particular game warrants further examination. If a teacher is trying to decide among several games, this can certainly help. The review itself should take no more than an hour to complete, though some games may take more, and with the large number of walkthroughs and game videos available on websites like YouTube, the review can often be completed without even having to buy the game.

This brings the second part of this book to a close. We have now done our homework to uncover the theory behind game-based learning and pedagogy, and we have become armed with a workable tool we can use to help us evaluate games in a consistent and structured way. Part three brings us into the classroom to look at ways to design lessons, units, and even entire curricula using videogames.

References and Resources

Resources

minecraftedu.com—developer website containing resources and lesson plans to go with the educational version of *Minecraft*.
physicswithportals.com—teacher maintained website containing lessons and resources for teaching physics using the puzzle room maker from *Portal 2*.
teachwithportals.com—developer website containing resources and lesson plans to go with the puzzle room maker from *Portal 2*.

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Part III
Using Games

Chapter 8
Designing Game-Based Pedagogy

> *"One of the most difficult tasks men can perform, however much others may despise it, is the invention of good games. And it cannot be done by men out of touch with their instinctive selves."*
>
> *Carl Gustav Jung*

At-A-Glance

This chapter looks at game-based pedagogy from the design perspective. It begins by considering who our learners are and who digital natives really are. Then there is a second look at the teacher's roles in DGP and what it means to enter the magic circle. Further, there is a look at the wicked problem of creating lessons that use games and create a rough hierarchy for learning interventions which we use to help us scope the lesson planning task. Finally, the chapter considers instructional design as it applies to DGBL and looks at how to leverage some ID models for our purposes.

Chapter Goals

- Consider today's digital native and look at what that means to game-based pedagogy.
- Examine the connection between instructional design, lesson planning and Wicked Problems.
- Explore the instructional design models that are most relevant to digital game-based pedagogy.
- Develop an instructional design model for using games in the classroom

Key Terms

These are the terms introduced in this chapter. Definitions for these terms can also be found in the glossary.

- Learning activity

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- Magic circle
- Mise-en-scène
- Play-testing
- Scrum
- Subject matter expert (SME)
- Wicked problem

8.1 Introduction

In this chapter we look at the design part of the game-based education puzzle. We tackle instructional design (ID) and lesson planning (LP) in tandem. Much of ID focuses on the learner—what they will do, how they will do it, and how they will be measured. However, it rarely looks at what the teacher will be doing. Lesson planning fills in those gaps. If we are lucky enough to have well-designed courses given to us, then lesson planning is largely a matter of taking those materials and organizing them so we can present them in the most effective way possible given our current students, constraints and resources. These resources and constraints include such things as time, tools, assessment and reporting requirements, to mention just a few. If we're not so lucky, we start with some raw materials and vague learning objectives and build a lesson using approaches that combines both instructional design and lesson planning.

When it comes to game-based learning and pedagogy we've come along way in the last decade or so. Unlike 10 years ago, there are now very few educators who are completely against the use of games in the classroom. I conducted a survey in 2005 asking teachers if they would be willing to use games in the classroom, and if not, what was stopping them, and about a quarter of the respondents reported that were against the use of games in the classroom. In the words of one respondent:

> I think that the time to use games, the quality of the games and a limited number of computers are the key factors in not using computer games. As a parent I object to having my child "play" on the computer when he has completed some piece of work. I want my kids working at school … My students come to school to learn not to be entertained. Would you want your university profs. entertaining you? (Becker & Jacobsen, 2005)

Not only are most teachers OK with the use of games, about half use games in the classroom for something at least once a week (see Fig. 1.4) (Takeuchi & Vaala, 2014). We're certainly not there yet, but that's pretty significant progress. In case you're wondering the answer then, as now was, "Yes I do want my university profs to entertain me," but if that were all they did, I would feel I'd been cheated.

In the field, we've also learned a great deal about how to research games for learning in over the last decade. According to a 2011 review of the state of game-based learning, many early studies were flawed and of limited use, but more studies now are paying close attention to the design of their studies as well as the kinds of games they choose to study (Felicia & Egenfeld-Nielsen, 2011). This is good news. Game-based learning is starting to become mainstream. This chapter brings us another step closer.

8.2 The Myth of the Digital Native

First things first. Back in 2001, Marc Prensky (2001) coined the term "Digital Native" to describe those born after 1980 who have been exposed to digital devices their entire lives. In his landmark article, Prensky claimed that this generation of kids processes information in a way that is different from previous generations: they multitask, they are used to nonsequential information, and they play video games. The rest of us were labeled as digital immigrants. He said that we needed to change how we taught in order to address these differences. Since then, the term has become popular, especially in educational circles, and is often used as a justification for making broad assumptions about the digital literacy of young people today. Many assume that because digital devices are so frequently used, it must follow that the users understand that technology.

It turns out Prensky's claims were not quite true, but his bold statements raised awareness among many researchers and practitioners and did much to further the field of game-based learning, so his characterization of the digital native is responsible for some significant advances in our understanding of games and technology in twenty-first century learning.

> The picture beginning to emerge from research on young people's relationships with technology is much more complex than the digital native characterisation suggests. While technology is embedded in their lives, young people's use and skills are not uniform. There is no evidence of widespread and universal disaffection, or of a distinctly different learning style the like of which has never been seen before. We may live in a highly technologised world, but it is conceivable that it has become so through evolution, rather than revolution. Young people may do things differently, but there are no grounds to consider them alien to us. Education may be under challenge to change, but it is not clear that it is being rejected. (Bennett, Maton, & Kervin, 2008)

A 2011 study of undergraduate students' technology use found that students tended to use a fairly limited number of well-established technologies and found no evidence that these students learn differently from previous generation (Margaryan, Littlejohn, & Vojt, 2011). Bulger, Mayer, and Metzger (2014) then conducted a study that looked at how well education graduate students were able to locate and use information in a targeted research exercise. They found that digital literacy is more closely connected with academic literacy and an ability to make use of information than with technology use. It has much more to do with how people use the information they access as opposed to how much or how frequently they access it (Bulger et al., 2014). In other words, simply being connected does not make one literate.

So, what should this mean to instructors?

We should not assume that the kids in our classes understand the technology they use simply because they are classified as digital natives. For that matter, it may not be appropriate to assume that all students in a class are even familiar with a particular technology, especially not if one plans to use it in a specific way. On the other hand, this is not a reason to dismiss games. It just means that we need to be more deliberate in our approach to using games. An understanding of the roles we will play during the lessons is an important part of that. If you wish to use games more frequently then it may also be worthwhile to spend some time looking at games in general—how they work and how we can use them. After all, we teach students how to work in labs and other environments; therefore, why not teach them how to work in games?

Finally, no matter what kind of technology we use, there are kids in classes who already know what is being covered. Back in the "old days" we addressed this by giving them enrichment activities, or simply allowed them to pursue some other, usually quiet activities, while the rest of the class did the assigned lesson. There is no reason we can't do something similar when we find kids in the class who are already familiar with a particular game. We can let them work through the game at a different pace, or we can take advantage of their expertise to let them help others.

8.3 Teacher Roles and the Magic Circle

Given that we now have a better understanding of who today's digital natives are, it is time to turn again to the roles that the teachers play in a game-based learning scenario. Far from thinking that games would replace teachers, we now come to realize that the role of the teacher in this approach can be significant, and we have recently begun to try and understand those roles better. We talked a little about teacher roles in Chap. 6, but the knowledge available in relation to the pedagogical roles involved in facilitating game-based learning is still in its infancy (Hanghøj & Brund, 2011). In his study, Hanghøj was able to identify four broad teacher roles: Instructor, Playmaker, Guide, Evaluator. Tzuo, Ling, Yang, and Chen (2012) listed the roles teachers are known to play in game studies, including observing students' game-play, scaffolding, serving as a consultant to students, and providing them with meta-cognitive aids, among others. In many ways, this describes the role of an expert guide. The notion of an expert guide turns up elsewhere too. Barab, Pettyjohn, Gresalfi, Volk, and Solomou (Barab, Pettyjohn, Gresalfi, Volk, & Solomou, 2012) suggested that teachers could become expert guides by helping students navigate the nuances of a game and make connections with the learning objectives, adopt multiple pedagogical approaches to support student reflection and provide feedback and discussion, and aid students to understand the relevance of their academic knowledge beyond the course.

In a study of a homicide detective elearning game by Magnussen (2007), it was found that teachers were not always clear on how to approach helping students in the game. In one part of the game players needed help to take fingerprints, but those fingerprints may or may not end up being used elsewhere in the game. One teacher interprets this as meaning that the activity is more important than the results and tells his students so. Another teacher focuses on the professional work of the investigation within the game. In the first case, students become disengaged because the teacher has undermined the game. In the second case, the teacher was effectively role-playing as someone who might be a part of the investigative team. To understand how these differ we must understand a little about the *magic circle*. One theory suggested by Huizinga is that when one plays a game, one willingly enters this magic circle, which affords the player certain freedoms not normally available to him or her. Among those freedoms are included the ability to experiment (with ethical, moral, and many other choices) in a manner not permissible in the real world, and with little or no real risk (Huizinga, 1950). This freedom endows the medium of games with a potential of highly significant value to education.

Games (and play) exist in a space somewhat apart from reality: "the magic circle." Within this magic circle things are permitted that sometimes cannot (or should not) happen in real life, yet we can learn things from games that we can still apply to real life. Children of almost any age seem to understand that this special realm exists, and there is some evidence to suggest that at least some animals understand this too: dogs, when play fighting, will display most of the behaviors of a real fight, but no-one gets hurt. Further, dogs will even adjust their play for different individual dogs, as well as different individual people. Yet there exist certain understood rules, for it is also possible to observe when one player "crosses that line" and steps outside of the magic circle. Suddenly, the dogs are no longer playing and the potential for genuine conflict becomes real. The distinction between a game and the real thing appears to be a fundamental one yet it is widely believed that skills and behaviors practiced through play are often applied to real life. In one experiment, Irenäus Eibl-Eibesfeldt the human ethologist discovered that polecats who are not given the opportunity to play with siblings did not know where to bite prey and rivals or how to hold females during mating once they grew up (Lorenz & Leyhausen, 1973). Thus play and games can and do generate sometimes essential learning that transfers to real life, yet even animals distinguish between "pretend" and reality.

"Within the magic circle, special meanings accrue and cluster around objects and behaviors. In effect, a new reality is created, defined by the rules of the game and inhabited by its players. Before a game of Chutes and ladders starts, it's just a board, some plastic pieces, and a die. But once the game begins, everything changes. Suddenly the materials represent something quite specific. This plastic token is you. These rules tell you how to roll the die and move. Suddenly it matters very much which plastic token reaches the end first" (Salen & Zimmerman, 2004, p. 96).

What this means is that it is possible for a teacher to hinder or even negate the learning potential in a game by the kinds of roles they take on during the lesson. These roles require skills that may not be intuitive and that are not normally acquired through teacher training or game manuals, but teachers need to strike a balance between playing roles to the extent with which they are comfortable, and playing no roles at all. In a game where the students are asked to take on a particular role it can be disruptive for them to have to step out of their roles in order to interact with the teacher (Magnussen, 2007).

Table 8.1 is a list of nine roles that teachers can take on in game-based learning scenarios. These roles are not mutually exclusive. It is common for a teacher to take on multiple roles at once as well as to slip back and forth between roles. If we heed the warnings of the preceding paragraphs then we will be somewhat cautious in how we do this so as not to undermine the game.

Table 8.1 Teacher roles

	Role	Magic circle	Description	Source
1	Evaluator	Not usually	Evaluating the game outcomes and students' learning experiences.	Hanghøj (2013)
2	Guide	Yes	Helping students achieve the learning objectives.	Tzuo et al. (2012), Barab et al. (2012)
3	Instructor	No	Preparing the students for the game.	Hanghøj (2013)
4	Observer	No	Non-interacting.	Tzuo et al. (2012)
5	Player	Yes	To prepare for session.	Emin-Martinez and Ney (2013)
6	Playmaker/helper/initiator	No	Getting students back on track with the game itself.	Hanghøj (2013), Magnussen (2007)
7	Referee	Maybe	Helping students work in groups or compete fairly.	Becker (2007)
8	Role play	Yes	A character who can help the player	Magnussen (2007)
9	Subject matter expert/consultant	Maybe	Helping students with the content.	Tzuo et al. (2012), Hanghøj (2013)

- *Evaluator*: This role is about evaluating the game outcomes and students' learning experiences. This may simply be a matter of recording data collected by the game or during play, but it may also involve helping the students to reflect on their learning and put it into a meaningful real life context.
- *Guide*: The guide provides scaffolding to assist students in reaching the learning goals. The guide does not offer answers but may ask leading questions or make suggestions to help students make progress. The guide may take on the persona of someone who complements the narrative.
- *Instructor*: This is the traditional role of the teacher at the start of a lesson. It involves preparing the students for the game by explaining the learning goals as well as any direct instruction related to either the operational use of the game or the in-game activities. This role is rarely played from inside the magic circle.
- *Observer*: This is a passive role where the teacher effectively tries to be a fly on the wall. This role is rarely played from inside the magic circle.
- *Player*: This is a role the teacher will usually take on before the lesson starts. In order to prepare for the lesson it is usually advisable for the teacher to play the game, at least for a while. This prepares the teacher to understand the roles the students will play and may alert to potential problems the students may need help with. This role requires a position inside the magic circle.

- *Playmaker/Helper/Initiator*: The difference between this role and the previous may appear subtle, but the Guide role has to do with the content and learning objectives, whereas the Helper/Initiator role assists with the operational use of the game. Helping students with the game itself. Communicating the tasks, roles, goals, and dynamics of the game, its narrative or other scenario as seen from the perspective of the player. This role is rarely played from inside the magic circle.
- Referee: This role is focused on helping the players to play together or to facilitate the kind of competition that will help students get through the game. This role is rarely played from inside the magic circle, although if it fits into the narrative, it could be.
- *Role Play*: When the teacher takes on the persona of a character within the game or one that fits within the narrative this is the role play role.
- *Subject Matter Expert/Consultant*: The *subject matter expert* (SME) is the person who has authoritative knowledge about a particular subject or field. When a teacher takes on this role, they act as consultants for players in matters having to do specifically with the subject matter covered in the game. This may also involve taking on a particular character or persona.

We will be using these roles when we develop our lesson plans.

8.4 Beginning at the Beginning

Let's start by looking at a hierarchical view of formal learning as shown in Fig. 8.1. Doing so allows us to focus on the lessons and consider how they fit into the bigger learning picture. It depends on the nature of the game of course, but there is potential for using a game at any level of this hierarchy. By now it should be clear that the kind of game we choose would vary depending on how long we want to use it. Clearly, a short form game is unlikely to be serviceable over the long term unless it is something like a puzzle game where the puzzles themselves are well matched to the progression in the curriculum. The amount of operational learning required as well as the typical length of time to get through the game are also important as they need to be a good fit with where your instructional plan fits on the hierarchy. Let's take a quick look at each one.

In order to keep things relatively simple, lets define a *learning activity* as an action the learner can be directed to do that can be assessed in some way even if it is only to note it as complete. A lesson would then consist of at least one learning activity and a unit would usually consist of more than one lesson. A topic may include multiple units and a domain represents an entire discipline or subject. Finally, we have a long range plan which may include a variety of disciplines. It all sounds very nice an tidy but we know that this is not the reality—especially when we consider twenty-first century teaching ideas such as being integrated, interdisciplinary, and interestXE based (Shaw, 2008). This kind of approach does not really result in a neat and tidy image like Fig. 8.1. The reality is much more like Fig. 8.2.

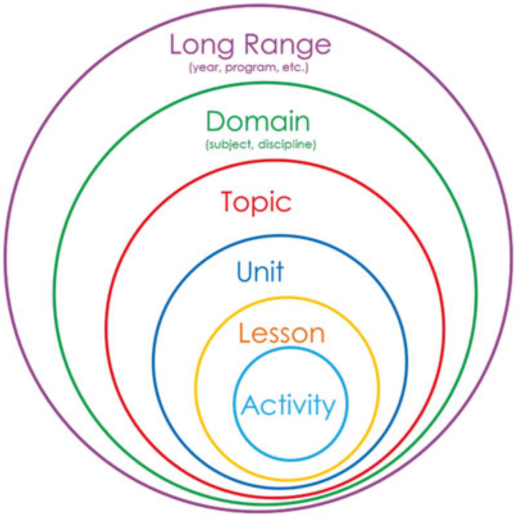


Fig. 8.1 Intervention hierarchy

If you are teaching or are responsible for more than one subject it is also useful to consider this perspective and while it's not normally possible to design, it is a good idea to keep this in mind; What other topics does this activity touch on? Can I make a lesson do double duty? How can I arrange the assessments to address curricular requirements in both (or all) topics? It's probably not advisable to try and pack too much into any single lesson, but it is possible to create multiple lesson plans that happen to overlap. In the end, it may be preferable to look at it this way than to create a single lesson where the objectives and assessments are too busy or intertwined. If we think or each lesson plan as a separate ingredient, we can view the lesson itself is the entire dish.

It is time to look at some instructional design models to see what can be applied to DGP.

8.5 Instructional Design and Lesson Planning Are Wicked Problems

People who work with tools need to understand those tools, and we sometimes undervalue the importance of technical acumen when creating artifacts. Some things are just more complex and demand a greater level of awareness than others. Film is more complex than print, as is the web. Games are more complex still. A

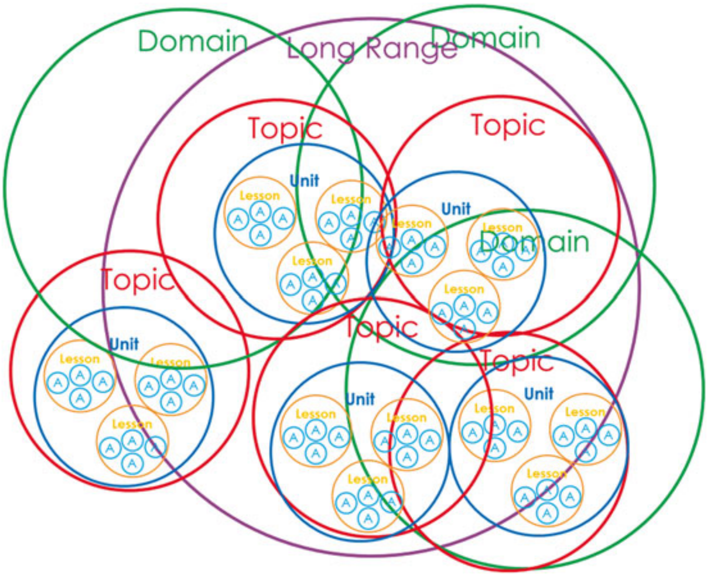


Fig. 8.2 Twenty-first century pedagogy

film director needs to know more than how to talk to actors, and a writer needs to know more than grammar. Clothing designers need to understand fashion, but they also need to understand color, textures, patterns, the fibers and fabrics they work with, and the bodies that wear their clothes—right down to the muscles and bones. Instructional designers need to understand learning theories and models as well as what goes into designing effective instruction, but they also need to understand their delivery medium—whether it be the web, or film, or print, music, or digital games. Teachers need to understand some of this too—especially if they wish to create their own lesson plans, as many do.

Part of why can be so hard is that instructional design is essentially a *wicked problem* as defined by Rittel & Webber (1973). The term "wicked problem" was first coined in the context of social planning. Originally, it had little connection to other disciplines, but perhaps due to its social context, it was soon taken up by business organizations and applied to organizational planning, as well as in architectural contexts and even software design. The following are the ten criteria for wicked problems along with a brief explanation of how both instructional design and lesson planning fit.

- *There is no definitive formulation of a Wicked Problem*. The understanding of the problem progresses as the solution does, and often the problem is not fully understood until the solution is complete. In the classroom, while there can be many similarities with other similar classes, each group of students is unique.
- *Wicked Problems have no stopping rule*. Since it is hard to define the problem, it is also hard to declare when it has been solved. In ID and LP we will rarely be able to say, "This is the one. This is the one perfect lesson for this topic."

- *Solutions are not True/False but Good/Bad*. There is no single right answer to the problem. Instead solutions are judged on their relative fitness for the purpose. This is related to the previous one—there is really no way to identify the one best lesson.
- *There is no ultimate test of a solution to a Wicked Problem*. Solutions to Wicked Problems have complex consequences and it is difficult to know how or when all the consequences will have been identified and addressed. Since each class is different, the best we will ever be able to do is collect a body of evidence to support the claim that a particular approach works. There is no definitive proof.
- *Each solution is a one shot operation*. The consequences to each solution are a result of the solution interacting with the stakeholders and target audience—thus they are unique. Even though we may have a standard ID or LP for a particular topic or class, each time we do it it will (or should) be somewhat different.
- *Wicked Problems do not have enumerable (exhaustively describable) solutions*. It is not possible to list all possible solutions and then choose one. There are effectively and infinite number of solutions. There is no way to list all the different ways to teach multiplication, for example.
- *Each problem is unique*. There is no well-defined algorithm (such as a software or instructional design model) for proceeding from the problem to the solution. This one is a tricky one since we do use various models and templates for both ID and LP. These models can only ever by guides and must be adapted for different situations. They can never be recipes that guarantee success.
- *Each problem is a symptom of another problem*. These problems are embedded in a social context with various issues that interconnect and interact. Thus changing one aspect often has ramifications to other aspects, creating a new problem. Though I'd rather not see teaching a lesson as a "problem," it is true that you will never have the luxury of being able to shut out all the other factors that influence what happens in your classroom.
- *There are a number of different stakeholders interested in how it is solved*. The roots of a wicked problem can be explained in numerous ways which will vary from stakeholder to stakeholder. Even in a fully funded public system there are multiple stakeholders, including, but not limited to: the teacher and school, administration, parents, the learners. It is not possible to design with only one group in mind.
- *The planner has no right to be wrong*. In other words there is a (perhaps) unreasonable expectation that the designers will produce a suitable, sound and appropriately effective solution in the first attempt. In our case, the ultimate objects of our efforts are the students in our classes, and although most of us who have been teaching for any length of time will have our own war stories of when things went wrong, this is not typically something we plan for at the outset. We always design and plan for success.

So, what do we do? The short answer is that we should do what we've always done—the best job we know how. The next section can help us with some frameworks for building great lessons.

8.6 Instructional Design Models for DGBL

Instructional Design works for game design. We can verify that games designed along learning and instructional theory lines can and do result in artifacts that remain compelling as games. But this does not mean that ID methods can be followed like recipes to produce successful games. We have not yet discovered a formula for generating blockbuster movies or classic literature either, but we still value formal training in film-making and in writing. It helps develop better writers, playwrights, and film makers and for that reason we will look at a number of ID models to see how they connect with DGP.

It's one thing to look at a finished game and extrapolate what kind of learning and instructional models are relevant like we did in the previous two chapters, but it is another to design a lesson using a game. There are some important differences in general game design versus games for learning versus instructional design, but there are some key overlaps as well as shown in Table 8.2.

If we accept that Serious ID is a wicked problem, the next obstacle to tackle is how to approach a solution. The problems are real, and solutions necessary. Knowing that a problem is wicked is of no use if that does not also help us take advantage of tools and techniques suited to addressing these kinds of problems. As is the case in many other design disciplines there seems to be a general recognition that no single approach to the design of instruction can work in all situations. Even those who support the most structured approaches will admit that these are often best suited to practitioners new to the field, by providing a support system. Experts who make use of these models often use them as rough guides, rather than prescriptions (Kenny, Zhang, Schwier, & Campbell, 2005). It is for this reason that this last set of models is included (See Fig. 8.3). They provide a variety of popular and well-known instructional design models as well as a few that are new. They will serve as a reference for us when we design and evaluate game-based lessons.

8.6.1 Generalist Models

The generalist models are ones that are fairly high-level. Two of them describe the design process in very general terms and the third describes the main principles that should be applied to every lesson. None are really usable by novices directly as none can be followed like road maps.

8.6.1.1 A.D.D.I.E.

ADDIE is a fairly high-level process view of instructional design. It isn't really a design model so much as it is a design pattern. It serves as an umbrella class of models that share the five basic phases of design. ADDIE is actually an acronym

Table 8.2 Comparison of perspectives of game design vs. instructional design

	Game	Serious game	Game for learning (G4L)	Instructional design
Basic definition	This term includes all the other categories *except* Instructional Design.	A game *designed* for purposes other than or in addition to pure ente rtainment	A game *designed* specifically with some learning goals in mind	The creation of learning
Purpose	Can be for any purpose	Change in behavior, attitude, health, understanding, knowledge	Normally connected with some educational goals	Change in behavior, attitude, health, understanding, knowledge
Primary driver (why used)	Can be either play or rewards (or both)	To get the message of the game	To learn something	To address some performance gap
Key question	Is it fun?	Is it engaging?	Is it effective?	Is it effective?
Focus	Player experience (how)	Content/message (what)	Content/message (what)	Content/message (what)
Budgets	Next to nothing to hundreds of millions	Next to nothing to hundreds of thousands	Next to nothing to hundreds of thousands	Usually part of institutional budget (in formal education)
Business model	User pays	Producer pays	Varies	Institution pays
Concept catalyst	Core Amusement	Message.	Performance or Knowledge Gap	Performance or Knowledge Gap
Fidelity	Self-consistent, otherwise irrelevant	Faithfulness to message essential	Faithfulness to message essential	Faithfulness to message essential

which stands for: Analysis, Design, Development, Implementation, and Evaluation (see Fig. 8.4). It is intended to provide a framework for the design of training and instruction. It is very similar to the universal design model (Fig. 3.2), and is really too generic. The five parts of the ADDIE model are outlined below:

- Analysis: The process for defining desired outcomes.
- Design: The process of determining how desired outcomes are to be accomplished—based on supporting system(s) needed, required resources, timetable, and budget.
- Development: The process of establishing requisite system(s) and acquiring needed resources to attain desired outcomes.
- Implementation: The process of implementing design and development plans within the real-world environment.

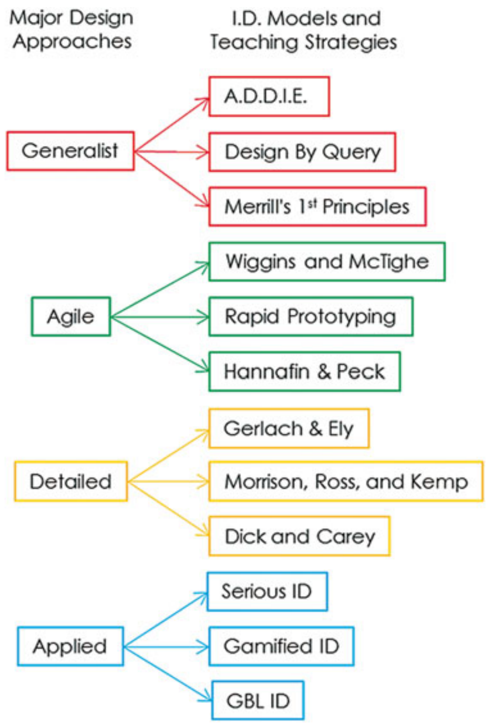


Fig. 8.3 Instructional design models and strategies

- Evaluation: The process of measuring the effectiveness and efficiency of the implemented system and using collected data as opportunities for improvement in closing gaps between actual and desired outcomes.

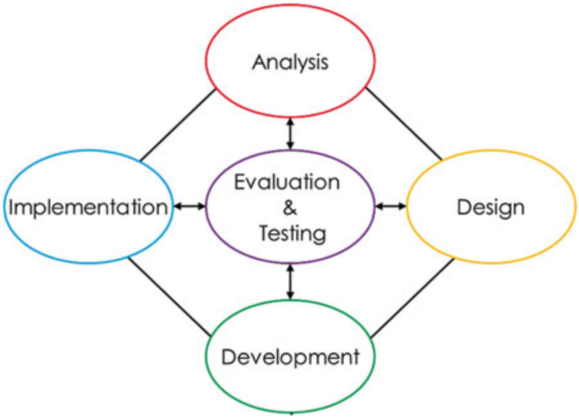
  The central role of evaluation and testing is an important aspect to remember.

8.6.1.2 Design by Query

Design by Query is another general model that was created in 2004 as a way to address the wicked problem aspect of I.D. (see Fig. 8.5). It involves creating a list of questions that need to be answered in relation to the instruction being designed which are them ranked according to their relative importance (Becker, 2007). Which questions become mart of the list vary from project to project, but some examples include:

- Is the group homogeneous (are all learners disabled or only some)? What percentage of the group is disabled?
- Is there an opportunity/reason/desire to treat learners differently (according to different skills, abilities, interests)?
- How much prep and in-service time is available to/required of the facilitator?
- What kind of work will learners be required to do? Is it optional? Is it graded? How? What are the weightings?

Fig. 8.4 A.D.D.I.E.



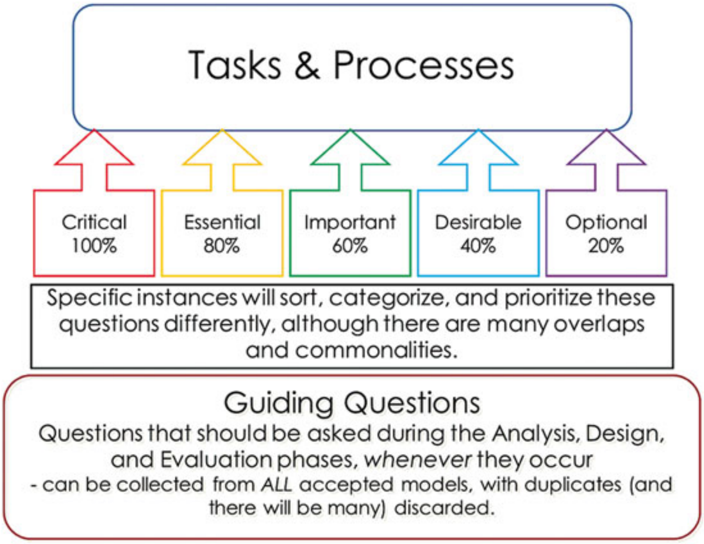


Fig. 8.5 Design by query

Once the list of questions has been created and ranked, they can then be addressed using what's known as a *scrum*, which is a way of completing a design or project that involves repeated rounds of development and review where the review examines what's been done and what's left to do and reorganizes it as appropriate. The next development rounds then proceeds with the new priorities (DeGrace & Stahl, 1990) and so on until the project is complete.

This model could incorporate questions from the 4PEG analysis model.

8.6.1.3 Merrill's First Principles

We look at this model in Chap. 6, so we do not say much more here other than that when it is used as an ID model (see Fig. 8.6) it serves as a checklist to ensure the fundamental elements are all addressed (Merrill, 2001). It has more direct relevance to lesson planning than some of the others as it addresses what the teacher should do over what the students should do.

We will keep this model in mind when we flesh out the details of our lesson plans.

8.6.2 Agile Models

The "agile" models are ones that include a fairly high level view of the design process and are meant to allow for a flexible approach. They tend to show a minimum number of steps or phases.

8.6.2.1 Wiggins and McTighe

This is a very popular model that is most useful in small applications. This makes it especially useful in lesson planning. It takes a reverse design approach in that it starts with describing what we want learners to be able to do and know upon successful completion. As shown in Fig. 8.7, it then proceeds to deciding how we will determine that learners have achieved these results, and finally proceeds to the instructional planning (Wiggins & McTighe, 1998).

The idea of beginning at the end is a useful one for our purposes as well.

8.6.2.2 Rapid Prototyping

The core idea behind rapid prototyping is to start building as soon as possible so it can be tested while changes are still likely to be easy to do (Tripp & Bichelmeyer, 1990). This approach advocates the creation of a functional, if incomplete version of the solution be created as soon as possible and it is this prototype that forms the focus of the design process. The actual design phase is in fact a fairly tight cycle of design—build—test—adapt. This kind of approach is common in game development where it is important to have a playable version of the game as soon as possible, even if it is incomplete. Ideally, this also includes extensive *play testing* so that the developers can ensure the game will work as intended. The actual progression is typically more cyclical than the linear model usually shown as in Fig. 8.8.

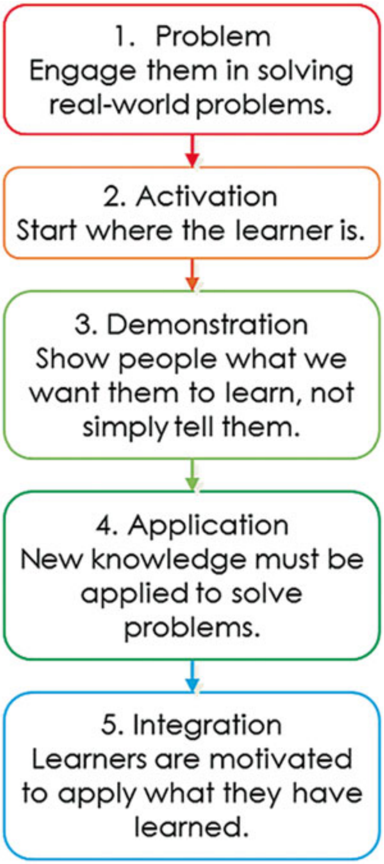


Fig. 8.6 Merrill's first principles

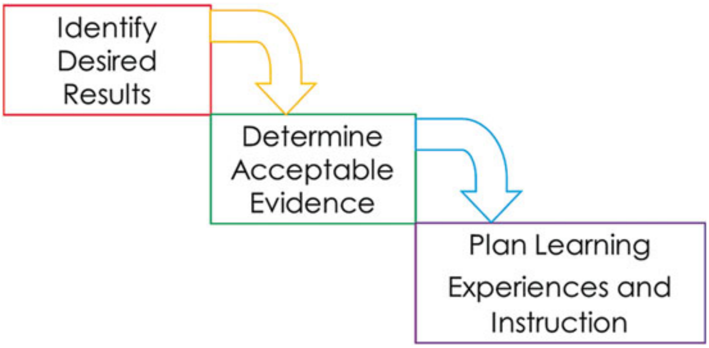


Fig. 8.7 Wiggins and McTighe

8.6.2.3 Hannafin and Peck

This is another simple model that breaks up the design process into three distinct phases: needs assessment, design, and development (Hannafin & Peck, 1988). It does however require evaluation and revision at each phase and as Fig. 8.9 shows, it is possible to revert to a previous phase after any evaluation.

Here again we are reminded of the fundamental importance of evaluation and revision.

8.6.3 Detailed Models

These include some of the classic instructional design models. They are systematic and detailed, although each one takes a distinct approach.

8.6.3.1 Gerlach and Ely

What sets this model apart from many of the others is that it includes specific mention of the allocation of various resources (Gerlach & Ely, 1980). Figure 8.10 shows the Gerlach and Ely model where the main design phase includes some of the practical considerations faced in the classroom. This is something that will be very important in designing a lesson that uses a game. The appropriate allocation of time and other resources are crucial in a lesson that uses a game. We must be sure to allow sufficient time for activities that will prepare the students to make good use of their gaming time. We need to allow sufficient time to actually play the game, but we usually also need to allow for time to debrief and reflect on the in-game experiences. In many cases it is during the debriefing that the important learning will take place. This model also reminds us to consider the learners' prior knowledge and skills via the assessment of entering behaviors.

8.6.3.2 Morrison, Ross and Kemp

This model is included because it presents a different picture form the typical linear or cyclical process. Part of the idea in this model is that the planning and revision "phases" should permeate throughout the design process, and this is certainly an important shift. It also includes mention of support services (Morrison, Ross, & Kemp, 2004). Still, the placement of the phases in a clockwise progression staring at the 12 o'clock position as shown in Fig. 8.11 still imply a linear progression. It does not make explicit mention of media though, and when teaching a lesson that includes a game, careful consideration must be given to the technology involved and how it will be supported. If we assume that "support" includes the media, then the idea that media support should surround the entire process as is shown here is a useful one to keep in mind.

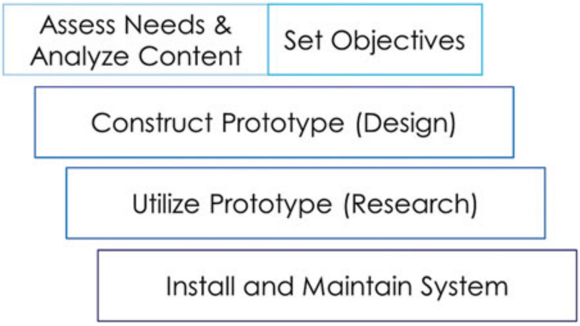


Fig. 8.8 Rapid prototyping

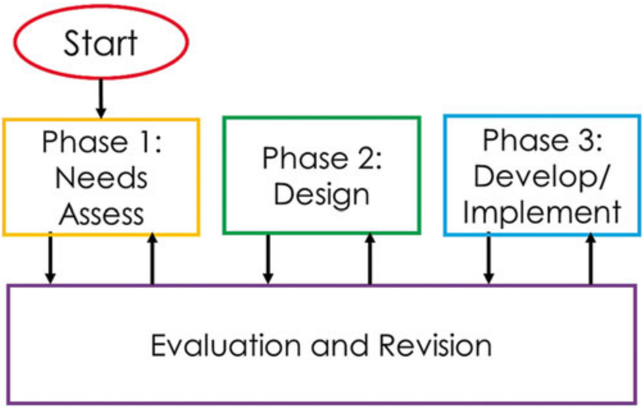


Fig. 8.9 Hannafin and peck

8.6.3.3 Dick and Carey

This model is another one of the classics and includes all of the typical elements considered essential to good instructional design (Dick, Carey, & Carey, 2001). It is a systems approach model and forms the visual basis for the GBL model we will present at the end of this chapter. It emphasizes a generally linear progression, but one that includes checks and balances along the way and opportunities for revision and correction. Like most systematic models, it is for the most part linear and follows a similar set of basic steps as seen in the ADDIE model (see Fig. 8.12). Like the ADDIE model shown in Fig. 8.4 it also includes the opportunity for revision throughout the design and development. A problem for us however is that it still places the development of the materials (i.e., media) near the end of the process just before the testing. When designing with games the choice of materials and media must come near the beginning.

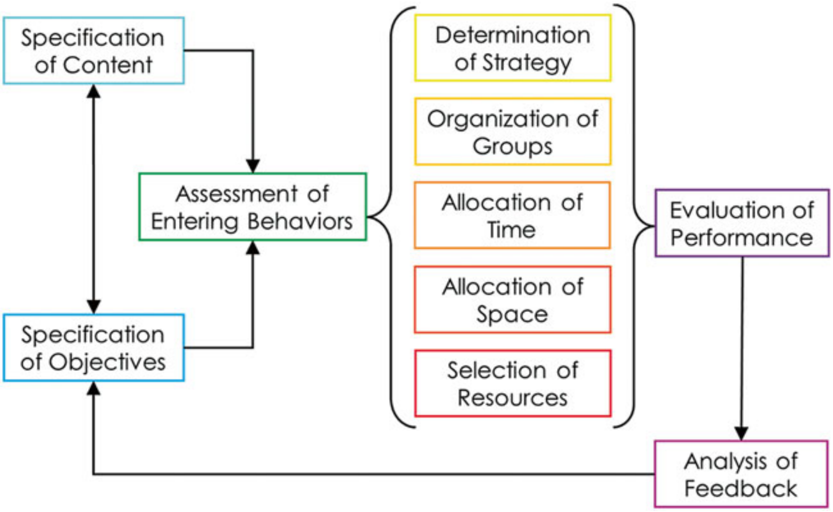


Fig. 8.10 Gerlach and Ely

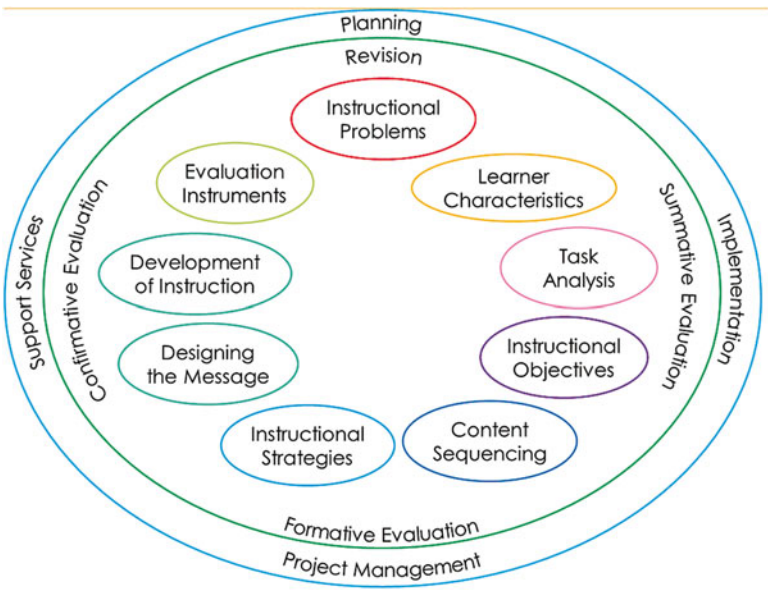


Fig. 8.11 Morrison, Ross, and Kemp

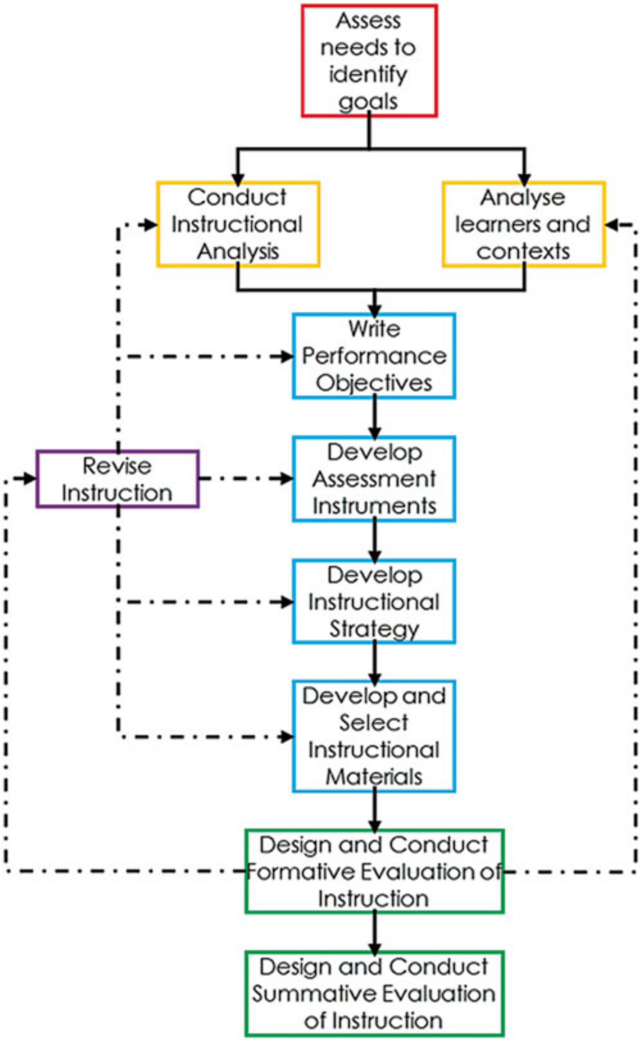


Fig. 8.12 Dick and Carey

8.6.4 *Applied Models*

Finally, the applied models approach instructional design using specific technologies. There are many forms of ID that are applied, but only those associated with games are included here.

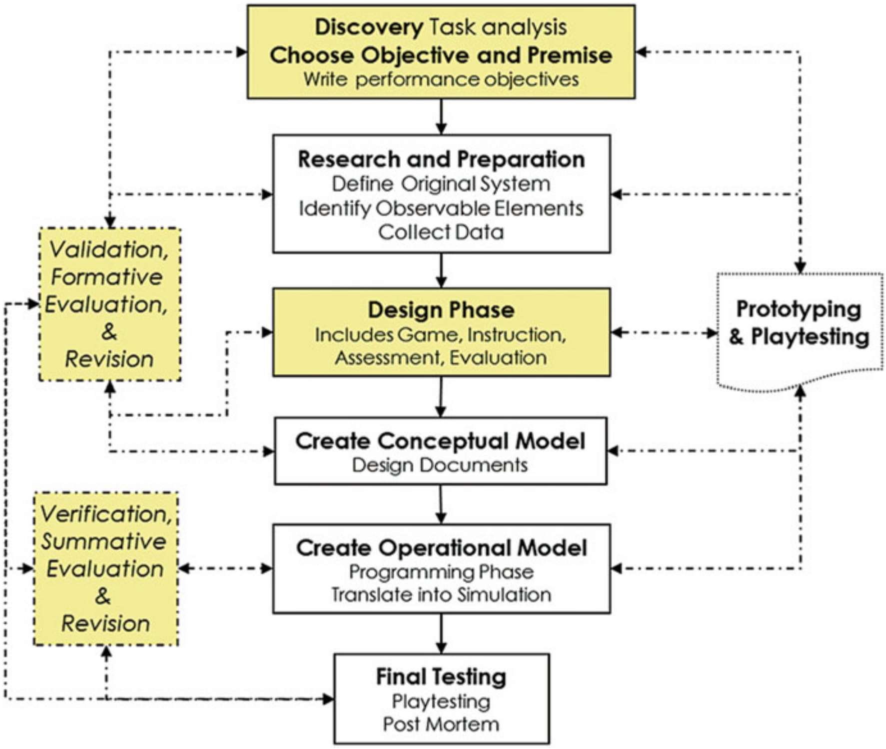


Fig. 8.13 Serious ID

8.6.4.1 Serious ID

Serious ID is intended for the design and development of serious games (Becker & Parker, 2011). It combines aspects of general instructional design, game design, and simulation design. It is intended for the development of the games themselves and can be used for many different kinds of serious games in addition to games for learning. One of the aspects of a game that we considered in the 4PEG model was its accuracy, and this model recognizes that. It is a synergy of both game design and instructional design approaches rather than having one layered on top of the other (Fig. 8.13).

Although we are likely not going to be building games ourselves it helps to have an understanding of how educational games should be built.

8.6.4.2 Gamified ID

We have hardly mentioned gamification in this book, but it is an approach that is gaining momentum in educational circles, so I'll include a model here to show how gamification of a lesson differs from a lesson using a game. Gamification does not include an actual game as part of the design. This is one I developed after designing

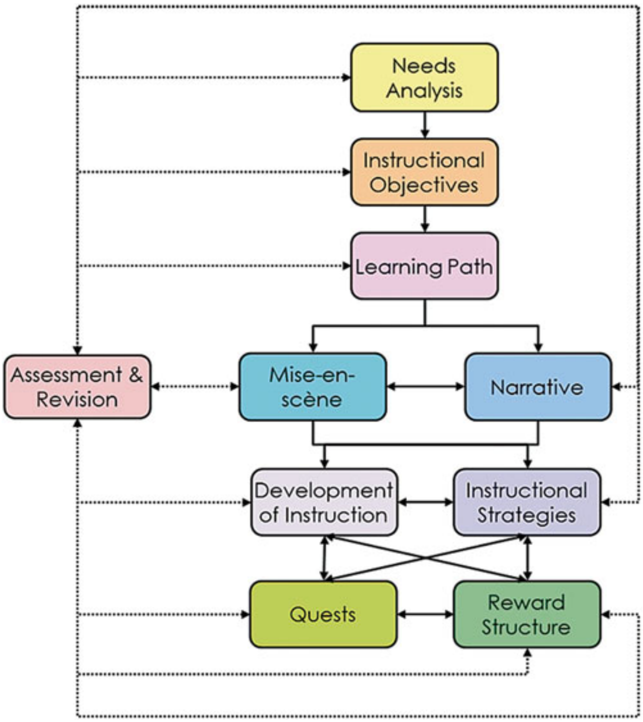


Fig. 8.14 Gamified ID

and implementing a number of award-winning gamified courses. It should be noted that the development of the narrative is optional.

We can see in Fig. 8.14 that there is no mention of an actual game anywhere. It does however include the development of various elements, such as quests and the reward structure that sounds more like a game than instruction. It also recognizes the importance of setting the stage and of the narrative, if present.

8.6.4.3 Game-Based Learning ID

Finally we come to the model the pulls it all together (see Fig. 8.15). Although all the others have elements that are useful, this is the one that applies directly to the creation of lessons that use games. We'll look at this one in more detail because it is the one we will use when we develop our lesson plan template.

Determine Needs, *Learner Characteristics*: When it comes to creating lesson plans, this phase will likely already have been decided, but it is often beneficial to state what you know, which can then be revisited in subsequent designs to make sure it is till appropriate.

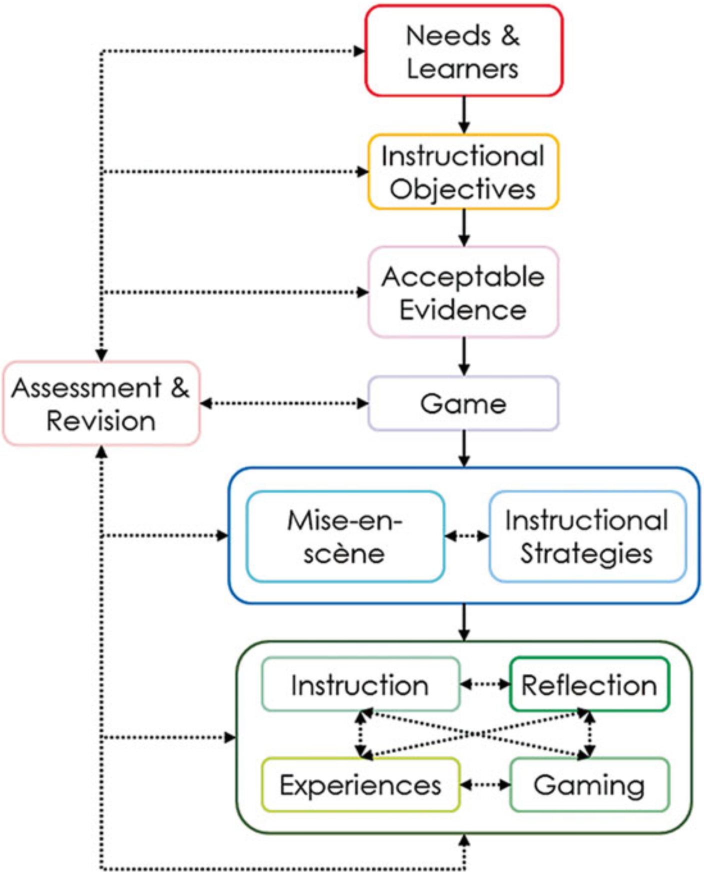


Fig. 8.15 Game-based learning ID

Determine Instructional Objectives: This part may be mandated and you may have no choice, but as with the previous phase, it can be very helpful to write it down in black and white.

Determine Acceptable Evidence: Wiggins and McTighe put this phase ahead of the planning of the actual instruction. Once we are clear on how we will determine whether or not our students learned what they need to, it is easier to create instruction to support their progress to those goals.

Design and *Conduct Predictive Evaluation of Game*(*s*), *Choose Game*, *Plan* and *Develop Tech Support*: It is really important that we be able to come to a decision about which game to choose early on, but this decision should only be made after we know what it is we want or need them to learn and how we plan to determine that they have achieved that. This is the "go–no go" point for deciding to use a game to support our lesson. If we can't find an appropriate game to use at this point, it might be better to go with a different approach. With the same token, if we chose a game too far ahead of this point, there is also the risk that we will end up adapting the lesson to something we can achieve using this game rather than using the game as a tool to help students get where they need to go.

Mise-en-scène: *Plan Time*, *Space*, *Resources*: *Mise-en-scène* means "setting the stage" and in our context refers to those aspects of the lesson design that include such things as the vocabulary we use, the preamble leading up to the game, as well as the real life physical environment that the students will be in when they play the game. It also includes such aspects as the timing of various aspects of the lesson (Gerlach & Ely, 1980).

Select Instructional Strategies: Armed with an understanding of what your students need to learn and the game you have chosen to help them get there, you can choose your instructional strategies in parallel with planning how you will allocate everyone's resources. This element is intertwined with the previous one so they are shown in the figure as being part of group.

Plan and *Develop Instruction*, *Learning Experiences*, *Reflection*, *Game Sessions*: The next four elements are also deeply interconnected so they are presented as a group.

There we have it. This final model combines some of the most useful elements from all the others to give us an approach that is specifically suited to the development of instruction that involves a game, whether it is a game design specifically for educational purposes or not.

8.7 Summary

I really hope that you do not find this and the preceding chapters too daunting. I've always thought it is better to have information we can ignore or discard than not to have enough. The goal behind presenting all of these theories and models is to provide a robust foundation on which we can build lessons using games that are grounded in research and established practice.

In the previous chapters we look at how people learn and some of the theory underpinning how we design learning experiences. This chapter begins to zero in on the teacher in the classroom and what we need to know in order to create solid, effective lessons in our classes. We see that today's digital natives aren't really so much different from the rest of us but at the same time we should neither use that as an excuse for not using games nor for assuming that all of our students will naturally take to games in the classroom. We look at how the teacher in the classroom will need to be able to shift roles from ones that are positioned outside of the magic circle to ones firmly anchored inside of it—sometimes on the fly and often adopting a variety of roles in the same session. We then examine a number of ID models and look at how they could help us in our lesson designs. The next chapter is where we put all of this to the test and develop a lesson plan template for game-based pedagogy.

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Chapter 9
Game-Based Lessons

> *A human being should be able to change a diaper, plan an invasion, butcher a hog, conn a ship, design a building, write a sonnet, balance accounts, build a wall, set a bone, comfort the dying, take orders, give orders, cooperate, act alone, solve equations, analyze a new problem, pitch manure, program a computer, cook a tasty meal, fight efficiently, die gallantly. Specialization is for insects.*
>
> *Robert A. Heinlein*

At-A-Glance

This chapter adds the last few pieces of the puzzle by outlining various ways that games can be used in the classroom. Although we have largely focused on games as content when it comes to using them in the classroom, there are other ways to make use of games. This chapter outlines 15 of them. While there are a growing number of sources who talk about using games in the classroom as an instructional strategy, it remains hard to find information on strategies that use games. The last piece of our puzzle is a big one. This chapter presents a list of 101 instructional strategies that are either specifically designed for games, or that have been adapted from existing strategies to make use of games.

Chapter Goals

- Examine various ways that games can be used in the classroom.
- List a wide variety of instructional strategies that have either been specifically designed for use with games, or that have been adapted from other contexts.

Key Terms

These are the terms introduced in this chapter. Definitions for these terms can also be found in the glossary.

- Conscious gaming
- Fan fiction
- Machinima

K. Becker, *Choosing and Using Digital Games in the Classroom*, Advances in Game-Based Learning, DOI 10.1007/978-3-319-12223-6_9

- Player versus environment (PvE)
- Player versus player (PvP)
- Targeted gaming

9.1 Introduction

While there are a growing number of people who talk about using games in the classroom as an instructional strategy, it remains hard to find information on strategies that use games. The last piece of the puzzle is a big one. This chapter presents a list of 101 instructional strategies that are either specifically designed for games, or that have been adapted from existing strategies to make use of games.

First, we have a few more questions to ask to ensure we have a good handle on the game we want to use. 4PEG is not quite enough by itself, although it tells us a lot. It helps us assess the game for a particular theme or topic area, but it's not necessarily detailed enough for a specific lesson, especially if we are also looking at reviews completed by other people. The 4PEG analysis is meant to be something we can do fairly quickly in order to help us eliminate games that are not likely to be suitable for our purposes and to get a solid handle on what the game has to offer. And now, given that we have a game and are ready to build a lesson using it, what else do we need to know?

The following are some questions we can ask to help us position the game in our lesson so we can make best use of the game as well as the time we have. Unless the game has been specifically designed for the classroom, there are likely to be some gaps to fill in. The answers to some of the questions that follow can help us decide what kinds of instructional strategies to pursue, which is an important part of the lesson planning process.

Here are some additional questions to ask:

- What is covered in the game and what is missing?
- Does it provide an overview of the topic (breadth) or does it focus on a particular aspect of it (depth)?
- Is this going to be a single play for one lesson or are we going to be spending multiple lessons with it?
- Are there factual or conceptual errors in the game? Is there inaccurate or misleading information? How do we want to address those? They could be teachable moments or we could simply note them and try to avoid them.
- Are there alternate viewpoints we can make use of?
- How will we manage gameplay?
- Does the game give us the option of saving a game at a particular point and then sharing that?

9.2 15 Ways to Use Games in the Classroom

Although we have largely focused on games content, when it comes to using them in the classroom, there are other ways to make use of them. We see examples of other ways to approach GBP in Chap. 7. For example, *Gone Home* was used as a form of literature and *September 12* was suggested as a lesson opener. *Minecraft* was used as a building environment and *Portal 2* as a physics laboratory. Many teachers are interested in using games in the classroom; but, at the same time many are not aware of the different ways that games can be used. The following section outlines 15 different ways that we can use games in the classroom. It is important to note that these are not mutually exclusive categories and it is possible to make use of a game in more than one way at the same time. After all, this is done with other media as well. The list that follows is summarized in Chap. 12 as well for easy reference, but here is where you will find a more detailed description along with examples.

9.2.1 Content

The content of the game directly addresses some curricular need. It may contain knowledge or concepts that connect with some part of the curriculum. Games that involve drill or that ask specific quiz style questions are obvious candidates here, but this could also include a game set in a particular time period that might be used in a history class, or one where the behaviour of the characters in the game illustrate some concepts that can be analysed or discussed, such as bullying. It may also include games where the actions the player must perform connect with curricular objectives (Fig. 9.1).

Example 1: *Angry Birds* can be used to explore the physics behind trajectories. This game involves “firing” an angry bird at a structure in order to knock it down and get at the green pigs hiding inside. The physics used to project the pigs to their targets are quite accurate and can be used to explore principles of motion and Newton’s Laws of Motion.

Example 2: *The Blood Typing Game* could help students learn about the basic blood types. This is a short form game that involves determining a patient’s blood type and then providing him or her with additional blood of a compatible type. This game provides the basic factual information on blood types and allows students to experiment with giving different blood types.

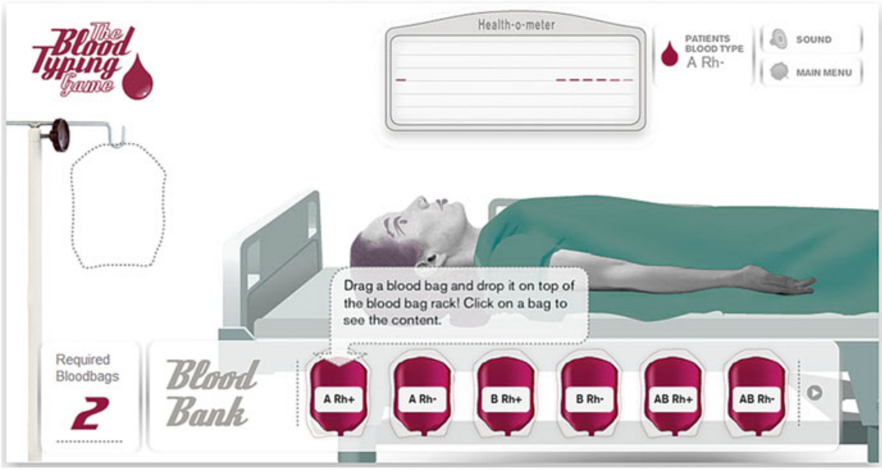

Fig. 9.1 The Blood Typing Game © Nobel Media AB, *Source*: nobelprize.org

9.2.2 Process

Here process is defined as a series of steps taken to achieve a particular goal. These are the kinds of things that allow us to understand *how* to do something or to answer *why* something is the way it is. A game can be used this way if one or more processes the players must follow or experience within the game connects with a broader curricular objective (Fig. 9.2).

Example 1: A general outcome in social studies might be: *Students will explore the relationships among identity, nation and nationalism.* A game such as *The Parable of the Polygons* could be used here. It is a game where players get to choose how to populate a neighborhood of squares and triangles, where the squares and triangles are metaphors for different kinds of people. Certain configurations result in happier polygons than others. The way that polygons are made happy or sad is a process that can be studied and discussed.

Example 2: A game such as *Civilization*, where players attempt to build civilizations and conquer others can help learners understand about the process of building a civilization, such as why it is advantageous to build your town on a river. The historical facts of the game are not always accurate, so it may not be useful for the study of historical events except perhaps as a counter-example. Civilizations that did not exist in the same time periods can coexist in the game and even attempt to conquer each other. However, the advantages and disadvantages of various strategies are representative of real ones, and the game is complex enough that these can be studied and discussed in relation to real civilizations.

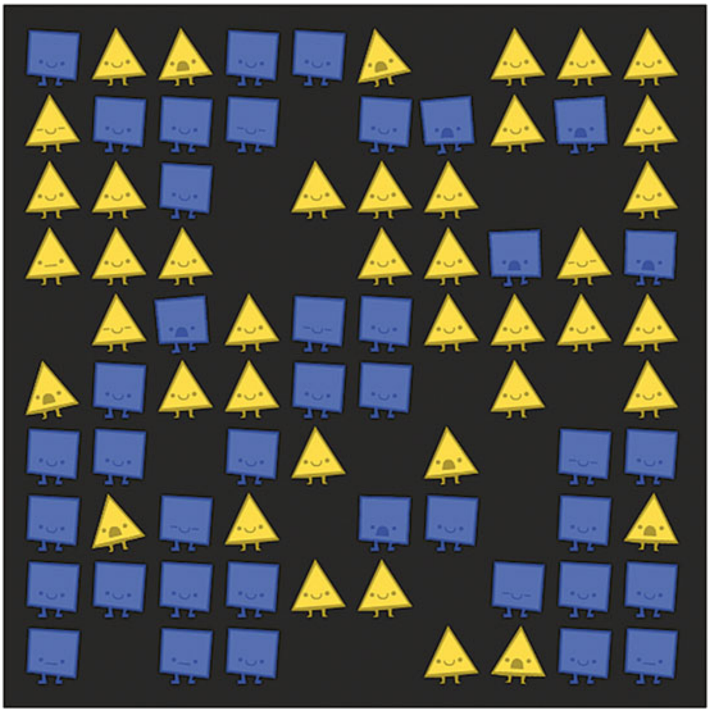

Fig. 9.2 Parable of the Polygons Public Domain Image Vi Hart and Nicky Case

9.2.3 Example (Case Study)

In this case the game is being used as an example of or an *artifact* that supports what is being taught. Rather than the subject matter of the game, if there is something about this game that connects with the objectives then it can be used as an example. It may be the artistic style that is of interest rather than the game's goals, or the approach it takes to *deliver* its message rather than the message itself. There may be something about the characters within the game that is worth studying, or the game's moral stance (Figs. 9.3 and 9.4).

Example 1: Using *Monument Valley* as an example of perspective in drawing and of the differences between two- and three-dimensional images. Monument Valley is a puzzle game where players must find a path to a prize along an Escher inspired structure. Often the structure can be turned so that pathways appear to connect up when viewed from the perspective of the player. In this game, if they *look* like they connect, then they do.

Example 2: "I sometimes require all of my students to play a popular game in the weeks immediately following a unit on Freud. I challenge them to analyze the game like a dream" (Shapiro, 2012). In this example, the game is used as a case study for something completely unrelated to the game.

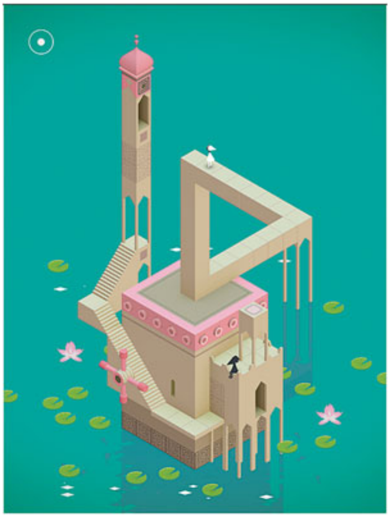

Fig. 9.3 Monument Valley
© UsTwo Games

Fig. 9.4 Monument Valley
© UsTwo Games

9.2.4 Counter-Example

The game contains artifacts or concepts that are incorrect, or inconsistent, or it is in some other way a counter-example of something that is being taught. There seem not to be many places where it's OK to point out problems and inaccuracies where we don't really have to worry about offending the author or political correctness. Games can provide us with something to consider.

Example 1: *Assassin's Creed II* is a game set in the time of the Renaissance. Although developers of *Assassin's Creed* claim to have created an historically accurate game (Starkey, 2015), there are still some issues that could be used as examples in a history class. Inaccuracies can be examined and discussed. Sometimes more can be learned from examining what is wrong with a setting or scenario than from one where everything is correct. As mentioned in Chap. 4, this game includes violence, so would only be appropriate in a senior high school setting.

Example 2: *Dora at the Dentist* is a game where the popular children's character from the Dora the Explorer series goes to the dentist. The player is the dentist and must clean and fix her teeth. Although the idea behind the game is a good one, the way in which the player gets to clean and fix Dora's teeth bears little relation to reality. This game could be used as a counter-example in a lesson on dental hygiene.

9.2.5 Inspiration

Games can be used as inspiration for creative writing, for construction, as examples of scenarios, or as role models. It is possible to use a part of the game rather than the entire game, such as a cut scene or a video of the game play, or even just a single image (Fig. 9.5).

Example 1: *Real Lives* takes players through the life of a single individual, randomly assigned to them using global statistics. The progresses in fairly large steps, sometimes covering an entire year in a single turn. One way to use a game like this as inspiration is to have students play through one life in the game and use that character as a basis for a fictional story, biography, or newscast.

Fig. 9.5 Gone Home, Family Portrait © The Fullbright Company, 2013–2016

Example 2: Another possibility would be to use a game like *Gone Home*. Students can be asked to play through the game and consider an alternate ending. The story in this game unfolds as the players discover clues that can be found all over the house. If an alternate ending were proposed, what kinds of clues would need to be changed and in what way? *Gone Home* is discussed in some detail in Chap. 7, and it is used as the game in a unit plan in Chap. 10.

9.2.6 Literature

Games can offer unique perspectives on story, as is evidenced by this quote about the game *Gone Home* from high school English teacher Paul Dorvasi.

> As a text, it exemplified the literary strategy of revealing character through setting. Its prolific and diverse documents might help instruct on how the conventions of language change, depending on intent and purpose. The nuances of each character yield ample ground for analysis. The game's emphasis on coming out, adolescent romance and rebellion would resound with my high school students, and ideally prompt some meaningful discussions. *Gone Home* also opens the door to delve into non-linear narrative, and how a coherent story can be told without railroading a reader along a set path. Finally, the lit geek in me was happy to note the game fulfilled Aristotle's dictums of the three classical unities more successfully than any of Shakespeare's plays.
>
> (Darvasi, 2015)

9.2.7 Art

Some games have a unique artistic style that is worth studying. Subjects that may find this approach useful include: design, creative writing, music, art, and theater. The art in a videogame can also be examined from a wide variety of perspectives, such as how race, gender, and sexuality are portrayed (McCarthy, 2015) (Fig. 9.6).

Example 1: *Machinarium* is a game with a unique artistic style that supports the character of the game (Verras, 2014). It is a *point-and-click* puzzle adventure set in a robot world that has seen better days. It is unique from a variety of perspectives, including the fact that the scenes were created from hand-drawn sketches rather than the much more common computer generated images. The game is presented in a comic-book style and has no dialogue whatsoever so all communication is accomplished using sound, imagery, and gestures (Fig. 9.7).

Example 2: *Limbo* is another game that has adopted a unique artistic style. When most games are presented with ever increasing realism, this one uses primarily silhouettes. *Limbo* is a platform puzzle horror game set in a world perpetually enveloped in shadows and dim light. The characters in the game have few visible features other than their outlines and their eyes. Most of the scenes are entirely grey, which focuses attention on the interactions and challenges rather than the inevitable death scenes.

Fig. 9.6 Machinarium © Amanita Design

Fig. 9.7 Limbo © PlayDead Games

9.2.8 Music

There are many aspects of video game scores that are worthy of study, from looking at examples of exceptional musical scores, to how the music enhances or detracts from the activity in the game, to various approaches to repetition. Unlike film and television, the scores in games are often required to be potentially infinite since it will rarely be possible to predict exactly how long a player will remain in a particular scene. This requires some way of making the score extensible. There are a number of ways of doing this, such as creating a simple loop, to creating more music than is required, to creating music on the fly using some sort of procedural programming (Fig. 9.8).

Fig. 9.8 Journey © thatgamecompany

Example: The game *Journey* was nominated for a Grammy award (Best Score Soundtrack Album) in 2013, and also won numerous other awards. *Journey* is an interactive parable; an anonymous online adventure where players experience one person's life passage and their intersections with the life journeys of others. Players start off alone in the desert and the goal is to reach a distant mountain top. Players are met with various challenges and can choose to go alone or with a stranger met along the way. The game is online, but unlike other online games, players cannot choose who to play with. Also unlike other online games, players can only communicate using the game's built in single chime as a form of "singing." The fact that sound plays a key role in this game combined with its critical acclaim make it worthy of astudy.

9.2.9 Lesson Opener

A short form game or even just the trailer from a game can be used to begin a lesson, as an advance organizer or to set the stage for the lesson that follows. When used as a lesson opener, it is normally assumed that students will interact with the game for only a short period of time, such as 5 or 10 min. The remainder of the lesson could then refer back to what happened in the game to help illustrate or underline various aspects of the lesson (Fig. 9.9).

Example 1: Students could be given a short period of time to play a game like *September 12* at the start of the class. Their experiences would then be included in discussions or other activities during the lesson. September 12 is a short form game that depicts a cartoon-like Middle Eastern village. The only thing the

Fig. 9.9 Pavlov's Dog, © Nobel Media AB, *Source*: nobelprize.org

player can do is aim a missile and shoot it, blowing up one or more buildings. There are always casualties, and some of the survivors become mourners who sometimes turn into terrorists. If players avoid firing their missile for long enough, then the buildings are rebuilt, and some of the terrorists turn back into ordinary citizens. The message is a simple one but can easily be used to spark discussion in class. This scenario is discussed in Chap. 10 where a Grade 12 social studies lesson is developed using this game.

Example 2: *Pavlov's Dog* is a game designed to show people the basic principle of classical conditioning. Players are presented with a sleeping dog, three objects they can feed to the dog, and three objects they can use to make noise. Players are to reenact the classic procedure for training the dog to salivate on command. Even though this game presents an overly simplistic view of this form of training, it is short enough that it can be played in a couple of minutes. Students could be asked to play this game at the start of a lesson or unit on behaviorist learning theories.

9.2.10 Homework

Games do not always need to be used during class time. Students can be asked to play a particular game out of class time in order to collect data, answer questions, or in some other way prepare for an activity that will be addressed in class. This would

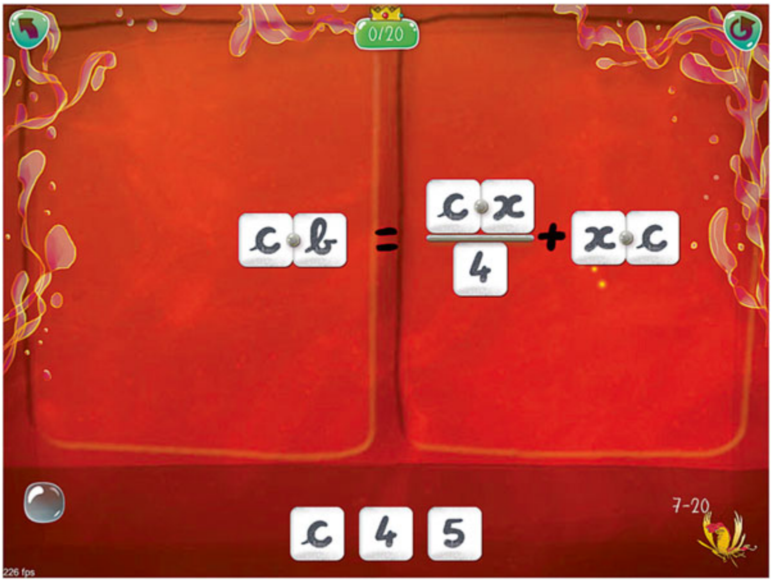

Fig. 9.10 DragonBox Algebra 5+ © WeWantToKnow

of course require that all students have reasonable access to the game, such as would be the case if they all had laptops or mobile devices (Fig. 9.10).

Example 1: Students could be asked to play a game such as *DragonBox Algebra 5+* at home for a specified length of time. This is a game that teaches how to understand and solve basic linear equations using drag and drop tiles. Later on in the classroom time can be used to focus on those parts the students struggled with.

Example 2: Students could be given a quest to complete in a premade map in *Minecraft*. They could do it completely as homework, or do a part of it at home and then finish it in class. One possibility would be to use it as a place to conduct surveys or gather other data. For example, they could be asked to stake out a particular area of space, note what kinds of blocks exist in that space and count them. This could later be used for a graphing or statistical exercise.

9.2.11 Medium

This is the constructionist approach to learning by building a game about the topic or concept being taught. There are numerous game engines that are relatively easy to use for this purpose and that don't require programming knowledge, such as *GameMaker* or *Scratch*. Some simple games can even be built using spreadsheets (Becker & Parker, 2011). It is also possible to build playable paper prototypes of games. Some kinds of lessons would be too complex to create an actual game, but exploring the design of such a game can still yield useful insights.

Example 1: One study involved getting a group of 10 year old children to make games about fractions for a different group of younger children (Kafai & Burke, 2015). They found that the children who made the games were far better at understanding and representing fractions as than the control group that had not made games.

Example 2: Have the students design a paper prototype for a game about bullying. Designing and building a full-blown game would likely be too time-consuming as more time would be spent on the game esthetics and on getting the game to work properly than on the content, but if the goal is just to design the game, then the focus can remain on the subject matter. The creating of a paper or other object prototype allows students to get to a playable game quickly and then focus on how the interactions in the game enact the ideas they are trying to portray.

9.2.12 Environment

Sometimes a game can provide an environment for some activity or part of a lesson, even if the game doesn't address the curricular needs directly. In this case the game is effectively used as a laboratory space (Fig. 9.11).

Example 1: Suppose a general outcome for your grade is: *Students will organize and manipulate data*. A game like *Zoo Tycoon* includes a wide variety of variables that are tracked as the player progresses through the game. In this game players build and operate a zoo. They begin with a limited number of resources and can only build a few exhibits. How they choose to organize their exhibits affects the number of patrons visiting their zoo as well as their satisfaction and that of the animals being exhibited. If the patrons are satisfied, then the player earns money that can be used to further develop the zoo. A game like this could be used as the source of data collected at specific time periods, which could in turn be analyzed statistically and presented.

Example 2: Players can be asked to demonstrate their understanding of various forms of measurement in a prebuilt world in *Minecraft*. They could, for example be asked to create displays of different volume measurements for a variety of shapes that they can then present and explain to their classmates.

9.2.13 Virtual Environment

This use is separated from the previous one to underscore the idea that environments in games can be used to explore concepts, ideas, and actions that can't be done in real life. Using a game as a way to do something that is otherwise impossible is a special case of using a game as an environment—doing the impossible. In this way of using games we take advantage of the fact that environments in games can break

Fig. 9.11 Minecraft Image courtesy of TeacherGaming LLC

universal laws such as the passage of time or one's ability to do things at a microscopic or cosmic level. We can also use games as an environment for doing things that would otherwise be too dangerous or expensive (Fig. 9.12).

Example 1: It is possible to experiment with managing diabetes in *The Diabetic Dog Game*. In this game players are required to take care of a dog that has type-1 diabetes. Doing the same things with a real dog would be highly inappropriate. It would also take too much time. Doing it using a game allows players to not only learn how to do things right, but also what can happen if they do it wrong.

Example 2: Players can explore the consequences of various policy decisions in the case of a sever flood in the game *FloodSim*. This is a game you play as a senior minister in charge of flood mitigation, select from a menu of measures that can be applied against flooding. Players must consider a variety of factors, such as the risk of flooding in particular locations, and its economic importance. Players have a fixed budget and must allocate resources to try and minimize the impact of a flood.

9.2.14 Optional

A game could be offered as one of several ways to complete some assignment or other work. Here students can be given a choice between playing a specified drill and practice game, or perhaps completing a worksheet.

Example 1: Suppose that students are given an assignment that involves interviewing people and creating a data set that will be analyzed. Students could be given the option of interviewing other class members, random shoppers at a mall, or players in a multiplayer game. If they are collecting data that does not involve

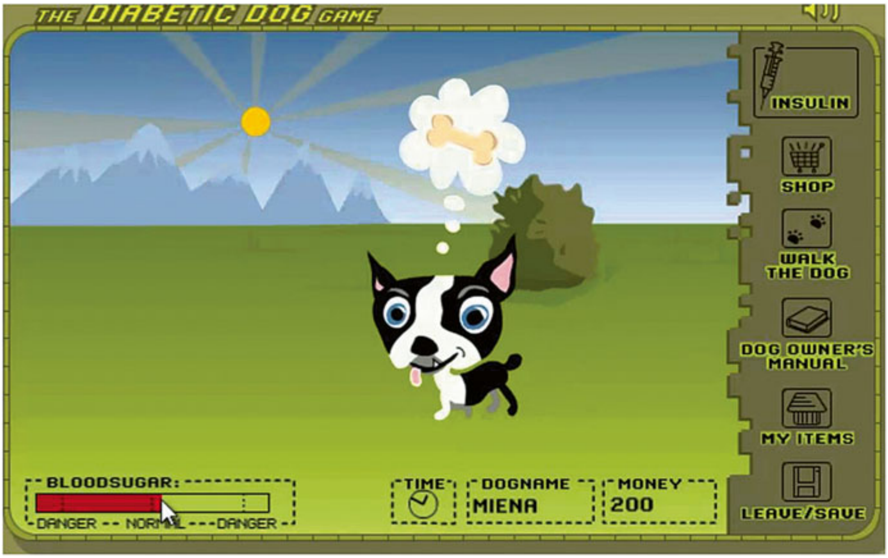

Fig. 9.12 The Diabetic Dog Game © Nobel Media AB, *Source*: nobelprize.org

asking questions directly (such as noting how many tall or short people pass a particular point in given span of time), then a single player game with NPCs could also be used.

Example 2: In an exercise where students are asked to create something to demonstrate Newton's First Law of Motion, one option could be to design and build a room using *Portal 2*. Other students might create real life demonstrations, and yet others may make drawing.

9.2.15 Pastime/Reward

Last, but still not least, is the use of games as a reward for good behavior or the completion of other work. This use of games does not really further any curricular goals but is included because it was once almost the only way that games were used in class. Fortunately, the value of games as learning technology is far more widely recognized but this use still exists.

9.3 101 Instructional Strategies for DGBL

The final pieces of our puzzle involve instructional strategies. These are the actual things we do in the classroom to bring all of our planning up to this point to fruition. This section contains a list of 101 instructional strategies. These also are also summarized and sorted according to whether they are pre-game, in-game, or post-game strategies in the resources section at the end of the book. There are a great many strategies that are quite generic in that they can be used with virtually any topic. The book's website has a list of places that provide various lists of instructional strategies, some with examples and lesson plans.

The ones listed here have a particular relevance for use with games—either because they were devised specifically to go with games, or because they've been adapted from another context, such as reading. In each case the strategy is briefly explained and its application to DGBL is outlined. Many of these are ways to promote structured and targeted gaming. A few require resources that are not yet available at the time of writing but could be developed. Finding original sources for many teaching strategies is a real challenge. Teachers are great at sharing resources, but it seems we often distinguish between research, which requires attribution, and practice, which doesn't seem to. Original sources for the strategy are provided where possible. If that is not possible, then the list it came from is cited as the source.

Many are best suited to games that have narratives, where the narrative connects with the educational learning objectives, but some can be used for other sorts of games as well. Most are only briefly described. Many are described more fully in the resources provided on the book's website. I'm sure that some will also inspire you to develop variations or entirely new strategies

9.3.1 1st TRIP (First TRIP)

Source: Farr, 2016)

Adaptation: K. Becker

Original Idea: This is a text perusal strategy intended to provide a structured "first trip" through a chapter. It is meant to help students pick out key clues from such things as headings, images, vocabulary, and so on in order to gain an idea of what the chapter is about. The name can be turned into the following acronym:

T = Title
R = Relationships
I = Intent of questions
P = Put in perspective

Game Strategy Adaptation: It can be applied to game-based learning. It will not always be possible to peruse a game level in the same way that readers can peruse a chapter, but it is often possible to have a look around and this strategy will help players do this in a targeted, organized fashion that will help them connect the learning objectives with their gameplay.

9.3.2 3–2–1 (Three–Two–One)

Source: (Lipton & Wellman, 1998)

Adaptation: K. Becker

Original Idea: 3-2-1 is a writing activity where students write six things subdivided into three categories, for example:

3 main points (or 3 "somethings")
2 controversial ideas (or two things I disagree with)
1 question related to the key concept or learning

The three categories can really be anything, but the first one, which contains three items, usually has to do with the main focus or objective of the activity.

Game Strategy Adaptation: This is a reflective writing activity performed after a games session. It is intended to help them consolidate their learning and prepare to focus their efforts for the next session.

3 key terms/ideas/facts they picked up from the game session,
2 ideas they would like to learn more about, or 2 concepts or skills they think they have mastered
1 question they would like to pursue, or one skill or concept they would like to master

9.3.3 Abstracting

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Abstracting is a thinking skill that involves summarizing and converting real-world events or ideas into models, where a model is some form of representation combined with a set of rules which can be used to predict the behavior and relationships between the various parts of the system. Models can be physical models, images, or written descriptions.

Game Strategy Adaptation: The DGBL variant adds an additional layer to this idea by converting in game events into models, which can then be connected or mapped onto real-world events.

9.3.4 Action Projects

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: The strategy comes from the research methodology called action research (Gay & Airasian, 2003). It is used to study educational issues, implement change and document professional growth.

Game Strategy Adaptation: A project where ideas learned through research are tested and applied within the game. This could be expanded to include a semiformal process or template for the project, such as:

- Rationale
- Goal
- Who is Involved (RL and virtual)?
- How are they involved?
- What will you do?
- What will you measure to determine success?
- How will you measure it?

9.3.5 AGO (Aims, Goals, Objectives)

Source: (De Bono, 1993)

Adaptation: K. Becker

Original Idea: A thinking strategy proposed by Edward de Bono to help students analyze the reasons behind their actions. According to de Bono:

- Aims are the general directions.
- Goals are the ultimate destinations.
- Objectives are cognisable points of achievement along the way.

Game Strategy Adaptation: They can be used to help focus our efforts within the game, but they can also be used as an action plan for a game session.

9.3.6 AIDA (Analysis of Interactive Decision Areas)

Source: (Luckman, 1967)

Adaptation: K. Becker

Original Idea: This is a creativity technique that is used when there are several inter-connected problems and the solution choices for one impact the solution choices for another. It assumes that we already have a number of potential solutions identified. These are written on sticky-notes along with the problems they solve. The idea is to create a matrix where the problems are listed along both axes, so that each cell of the matrix represents the intersection of two problems. Problems whose solutions interact with other problems are identified. The diagonal where identical problems meet up are blocked off. Any rows that remain blank at the end of the process have no interactions and can be dealt with separately. The solutions are then compared against other solutions to see if any are incompatible (i.e., they cannot coexist).

Game Strategy Adaptation: It is normally used for problem solving and it could certainly be used for that here too, but it has another application in DGBL. Here it can be used as an analysis technique to determine paths through a game.

9.3.7 Alternative Scenarios

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: This is a creativity technique in which students consider alternative futures. It is useful in writing to encourage students to consider several plots and endings for their stories before settling down to write. In social studies or science classes, this approach can be useful in helping students see possibilities, both for the present, and for their own futures.

There are usually thought to be four main types of futures (Dator, 1979):

1. Continuation: usually including some form of continued economic growth.
2. Collapse: from one or more of a variety of different reasons.
3. Disciplined Society: in which society is seen as organized around some set of overarching values.
4. Transformational Society: where some existing patterns or values and are replaced by new ones.

Game Strategy Adaptation: Applied to DGBL it can help students consider paths not taken in the game, or even to frame discussion around alternative endings and scenarios that the game designers might not have considered.

9.3.8 Anticipation Guide

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: An Anticipation Guide is a strategy that is used before reading to activate students' prior knowledge and generate curiosity about a new topic. It is meant as a form of advance organizer to help students examine a reading wand keep key concepts in mind. Before reading a selection, students respond to several statements that challenge or support their preconceived ideas about key concepts in the text.

Game Strategy Adaptation: An Anticipation Guide is a strategy that can be used before a game session to activate students' prior knowledge and build curiosity about a new topic. Before playing through a level or game, students respond to several statements that challenge or support their preconceived ideas about key concepts in the game. Using this strategy can stimulate students' interest in a topic and set a purpose for the gaming session. Anticipation guides can be revisited after playing to evaluate how well students understood the material and to correct any misconceptions.

9.3.9 Apprenticeships

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Apprenticeship is an ancient educational strategy where the novice works under the direct supervision of the expert in order to learn a trade, skill, or profession.

Game Strategy Adaptation: In the game, students can work under the guidance of mentors or tutors who take responsibility for the "professional" development of their apprentices. This can be a way to help students who are less familiar with the game than others to get up to speed.

9.3.10 Artifact Strategy

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: In the traditional approach, the teacher selects specific objects (artifacts) and presents them to the students. A problem is then posed and the students are asked to conduct research on the object. Once they are done the students can then formulate answers to the original problem.

Game Strategy Adaptation: In the GBL version we can either use real-life objects or ones that can be found in the game. A challenge is presented from the game, and the research can then be conducted in the game, in the real world, or both.

9.3.11 Autobiographies

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Autobiographies are normally life stories written by the person who experienced it. A way to apply them as a teaching strategy is to have students write them *as though* they were the person who had experienced the story.

Game Strategy Adaptation: In games, students can write the life stories of the characters they play in the game as a writing activity, or explore the lives of prominent people related to the narrative by reading published autobiographies.

9.3.12 Before, During, and After

Source: (Schoenbach, 1999)

Adaptation: K. Becker

Original Idea: Also known as *Pre-, During-, and Post-Reading*, these strategies work together to help students activate prior understanding, support comprehension during reading, and consolidate and use what they have learned when they read. This is a general metacognitive approach, and as a strategy, it is effectively a meta-strategy with a great many approaches that can be used for each phase.

Game Strategy Adaptation: Applied to gaming, it can guide students to explore the game and/or narrative:

- Pre-game to activate prior knowledge, monitor comprehension given a task, concept, or idea to consider.
- In-game, in order to summarize the session, consider pre-game concepts.
- Post-game, summarize, and reflect.

9.3.13 Biopoems

Source: (Abromitis, 1994)

Adaptation: K. Becker

Original Idea: These are poems written by students about any specific person or object in order to summarize student knowledge of the topic. The poem is normally a short prose that includes information about the object or character, such as:

(Line 1) First name
(Line 2) Three or four adjectives that describe the person
(Line 3) Important relationship (daughter of …, mother of …, etc.)
(Line 4) Two or three things, people, or ideas that the person loved
(Line 5) Three feelings the person experienced
(Line 6) Three fears the person experienced
(Line 7) Accomplishments (who composed …, who discovered …, etc.)
(Line 8) Two or three things the person wanted to see happen or wanted to experience
(Line 9) His or her residence
(Line 10) Last name

Game Strategy Adaptation: This can be used as is in a game. It can be applied to any character or object in the game.

9.3.14 Cascade

Source: (Jacks, 2005)

Adaptation: K. Becker

Original Idea: A cascade is a cooperative analysis of short, but critical, passages of text or graphics. It was originally described in a medical context where they are used to help understand medical errors. ("Toxic cascades: a comprehensive way to think about medical errors," 2001). In medicine there are thought to be four levels of cascade:

1. Trickles—they often go unseen but create inconveniences.
2. Creeks—are more obvious and can create barriers to progress.
3. Rivers—are too big to ignore and can redefine the landscape.
4. Torrents—these are powerful and can drown out conversation and make critical thinking difficult.

When applied to literature, the various aspects of the passage can be considered according to the four categories.

Game Strategy Adaptation: In the game version a cascade could involve key sequences of dialog or interactions and cut-scenes, this could also be used before the game to elicit ideas that can be revisited post-game.

9.3.15 Case Studies

Source: (Boehrer, 1994)

Adaptation: K. Becker

Original Idea: The case method originated in the teaching of law and medicine (Boehrer and Linsky, 1990). Case studies are real life problems that have arisen in the workplace that students must solve. They can also be used to explore interpersonal relationships.

Game Strategy Adaptation: In games we can use case studies in the first way by using them a structure to use while addressing in-game challenges. We can also use them for specific characters, levels, or scenes in games.

9.3.16 Checklist

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Checklists can be used to satisfy many objectives. They are useful as a memory tool or in encouraging creativity. They can also be used directly as assessments, or as a review tool in preparing for assessments.

Game Strategy Adaptation: In games they can be used to keep track of required objectives as well as places the players have been or items they have collected. Most games make this easy by providing easily accessible inventories and lists. Maps often highlight areas where the player has already been differently than those the player has not yet seen. Many games also show all the items that can be collected or accomplishments can be met along with those items the player already has. In games this can be used as a way to motivate players to continue playing. In an educational setting these can be used as a form of assessment to mark objectives that have been met.

9.3.17 Collections

Source: K. Becker

Original Game Strategy Idea: Many games allow players to collect items of various sorts. This strategy uses those collections as the source of projects, presentations, or writings related to the learning objectives. Players can be directed to gather collections of items that fit specifically with some concept or topic they've been given.

9.3.18 Collective Notebook

Source: (VanGundy, 1988)

Adaptation: K. Becker

Original Idea: This approach is intended to foster idea creation for problem solving. A notebook maintained by a group in which each member of the group is expected to add an idea or observation during a specified time period (typically each day or each week). The contents of the notebook are regularly shared or published and discussed. An advantage of this idea is that ideas have time to incubate and be affected by other's ideas as well as by things the group members do or learn in between.

Game Strategy Adaptation: This can be used in its original form when gaming to solve problems within the game, but it can also be used to help solve problems assigned outside of the game.

9.3.19 Competitions

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Competitions can be useful in motivating some students to learn, but competitions must be used with caution as it also increases stress for many students (Kohn, 1992). Some suggest that students may perceive the effects of competition differently when they are doing via characters (surrogate competition) in a game as opposed to having students compete with each other directly (Chen & Chen, 2013).

Game Strategy Adaptation: As most games have well developed scoring mechanisms, many lend themselves to this sort of strategy. Team competitions can be especially effective in the classroom if they are tied to a collaborative practice or review activity before the competition. In games there are two main types of in-game competitions: player versus player (PvP) and player versus environment (PvE). In the second the player plays against the game's artificial intelligence (AI).

9.3.20 Completed Work Chart

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: The teacher makes and publicly posts a chart that lists all assignments along the top and students' names vertically along the left. When a student finishes an assignment, the teacher marks out the box for that assignment on the chart so students can quickly see if they are missing any work. In this approach, grades are never publicly posted, and if work is so late it will no longer be accepted, the box is also marked out. The chart is used only as a reporting mechanism to let students know about work they need to do that will still be accepted for credit.

Game Strategy Adaptation: It is possible to use this as it to track assigned work, but it is also possible to adapt this to list in game milestones such as levels or other challenges. This is similar to a leaderboard, and some students find these kinds of charts demotivating (Becker, 2015), so a variation could allow each student access to a personal copy of the chart to track progress while the public version only lists the assignments.

9.3.21 Compositions

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Compositions are written work or music created by a student to demonstrate some literary, linguistic, lyrical, or musical knowledge.

Game Strategy Adaptation: Adaptations for use in DGBL can take many different forms, from extending the narrative or filling in gaps, to essays connecting in-game events to real world ones and beyond. Music compositions can similarly be intended to replace, augment, or suggest alternatives to what's in the game now.

9.3.22 *Conflict Chart*

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Conflict charts are used primarily in three areas of education:

1. As a graphical tool to help students understand the motivation of real people or fictional characters.
2. For scheduling purposes.
3. As a social and behavior management tool to analyze interpersonal conflicts.

The third use is beyond the scope of this book, but the other two have applications to DGBL.

When used to help understand motivation of real or fictional people, a conflict chart usually focuses on the kinds of conflicts faced by that person or character. This is often organized into four categories:

1. Person VS Person (or character)
2. Person VS Self
3. Person VS Society
4. Person VS Nature

Game Strategy Adaptation: For each of the characters of interest in the game it is possible to diagram or explain the conflicts they have with: other characters, themselves, nature, or society. In some games it might also be appropriate to add a kind of meta-category that considers conflicts between the character and the player. Since many games require players to adopt the morality inherent in the game or its characters, this has the potential to set up a fifth form of conflict where the player's motivations are examined in relation to those of the game or the character they are playing.

9.3.23 *Creative Problem Solving*

Source: (Osborn, 1963)

Adaptation: K. Becker

Original Idea: This is a brainstorming strategy that often uses a kind of checklist of questions to help move the process along. The nature of the questions depends on the nature of the problem, but could include questions such as:

- Is there anything else like this?
- Can some property be altered?
- Can anything be added, such as time, frequency, height, length, strength?
- Can it be duplicated, multiplied or exaggerated?
- Can anything be taken away or substituted?

Game Strategy Adaptation: A game approach to creative problem solving would involve having the students come up with a variety of ways to solve the problems presented in the game or posed by the teacher. Either the students or the teacher could create a checklist of questions. It would even be possible to build the checklist over multiple play sessions during one class or over several years.

9.3.24 Critical Incident Questionnaires (CIQ)

Source: (Brookfield, 1987)

Adaptation: K. Becker

Original Idea: A critical incident is an event that can be called to mind easily and quickly because it is remembered clearly. Critical incident questionnaires can be used to provide feedback for the teacher in order to adapt teaching to better meet the students' needs, or to help students reflect on their own learning. CIQs consist of five questions that ask the student to consider the current week's class and reflect on what they found engaging, distancing, helpful, confusing, and surprising.

Game Strategy Adaptation: The following are adapted for use with DGBL and can be used at the end of a game session or when they are finished with the game.

1. At what moment during your game session did you feel most engaged with what was happening?
2. At what moment during your game session were you most distanced from what was happening?
3. What action that anyone (in the game or out) took during your game session did you find most affirming or helpful?
4. What action that anyone took during your game session (in the game or out) did you find most puzzling or confusing?
5. What about during your game session surprised you the most?

9.3.25 Critique

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Critiques can take several different forms, but in education it often applied to a story of some sort or some project that has been completed. The critique can be applied to the content or the format. If we are critiquing a story we can critique the narrative, characters, or settings, but we can also critique the form of the story itself. For example if the story is supposed to be a mystery we can examine it from the perspective of the structure of a typical mystery. If we are critiquing some other product, like a presentation or report, we can similarly critique the content, or the form, or both.

Game Strategy Adaptation: In writing, students can experience and react to a game in its entirety or a specific portion of it, such as a single level or even a single event, by summarizing the event(s) and evaluating its correctness, relevance, or viewpoint. The artistic aspects of the game (visual and audio) can also be critiqued either in writing or through a discussion, to help students develop analytical and interpretive skills. Similarly, the gameplay can be critiqued to consider its "fitness for purpose." In other words how well the gameplay fits in with the kind of game it is and with its message.

9.3.26 CROWN

Source: (Jacks, 2005)

Adaptation: K. Becker

Original Idea: CROWN is a closure technique that encourages students to reflect on the completed lesson.

C = Communicate what you learned.
R = Reaction.
O = Offer one sentence that sums up what the whole lesson was about.
W = Where are some different places you could use what you have learned?
N = Note how well we did today.

Game Strategy Adaptation: This can easily be applied to the entire lesson, the game, or even just one part of the lesson or game.

9.3.27 DPTA (Directed Playing Thinking Activity)

Source: (Haggard, 1988)

Adaptation: K. Becker

Original Idea: Throughout reading, questions are used to activate students' existing knowledge. Students are encouraged to make predictions. Students are guided through the process of sampling text, asked to make predictions based upon prior knowledge and what they are reading, resampling text, and then confirming or adjusting their predictions while taking new information into account.

Game Strategy Adaptation: This is a variation of a strategy called the Directed Reading Thinking Activity. Throughout the gameplay session, questions are used to activate students' existing knowledge. Students are encouraged to make predictions while they play. They then play on and are prompted to reexamine their predictions in light of actual experience. This becomes a cycle that can be repeated throughout the gaming session.

9.3.28 Data Analysis

Source: K. Becker

Original Game Strategy Idea: Students can use games to gather data that can later be used for analysis and graphing. In a multiplayer game, students can create and design surveys to conduct within the game. For example, in a game where players can choose human or animal avatars, players could record how many characters of each type they have come across in a certain period of time and then ask those characters why they chose the characters they did. In a single player game other data can be collected. For example when you plant flowers in Animal Crossing they turn born and need to be watered after a time. Players could record plantings and when the flowers turn brown along with the locations and then analyze the data to see if any patterns emerge.

9.3.29 Debriefing

Source: (Raths, 1987)

Adaptation: K. Becker

Original Idea: An idea that's been used in military contexts for a very long time, debriefing in the classroom is often used to help guide students to reflect on and explain the meaning of their experiences and to help them integrate and thereby retain new learning. It can be used any time the students have gone through some kind of experience, such as after a lesson, or a field trip, competitive exercise, or classroom incident.

Game Strategy Adaptation: Debriefing is a crucial form of reflection that immediately follows a gaming session. Reflection is one area where many games are lacking so including deliberate reflection can mean the difference between a gaming experience having lasting impact and having it be dismissed as "just a game."

9.3.30 Double Entry Journal

Source: (Angelo & Cross, 1993)

Adaptation: K. Becker

Original Idea: The Double Entry Journal is intended to help students to record their responses as they read. As the name implies, a double entry journal has two columns: one for notes, quotes, and events, and the other for the writer's more personal thoughts and reactions from the reading.

Game Strategy Adaptation: This is relatively easily applied to games although allowances must sometimes be made for the fact that a game may only be interrupted or paused at certain points whereas one can pause reading a text any time. One (the left) is for notes, quotes, and events from the game as it is being played, and the other column is where the student records her thoughts.

9.3.31 *Exit/Admit Slips*

Source: (Andrews, 1997)

Adaptation: K. Becker

Original Idea: Exit Slips are written responses to questions the teacher poses at the end of a lesson to assess student understanding of key concepts. They should take no more than 5 min to complete. Their purpose is to allow the teacher to determine who is on track and who may need extra help. This allows the teacher to target the next session to the students' needs.

Admit slips are just like Exit Slips but they are done prior to or at the beginning of the lesson. Students may be asked to reflect on their understanding of their previous session or to help focus their attention for the upcoming session. Exit and Admit Slips can be used in all classes to integrate written communication into the content area.

Game Strategy Adaptation: This strategy can be adapted for use after the lesson or after the gaming session. It works best when the game session occurs at the end of a class and the teacher can hand out the slips just as the students leave. Similarly, Admit slips work best at the beginning of either the lesson, or the gaming session.

9.3.32 *Expectation Outline*

Source: (Farr, 2016)

Adaptation: K. Becker

Original Idea: This is a form of advance organizer similar to predictions (#68). Rather than making predictions about what's going to happen, students are asked to make up questions they expect to be able to answer by doing the activity.

Game Strategy Adaptation: A pre-gaming activity in which students consider the game they are about to play, then write down some questions they expect to be able to answer, or key concepts they expect to learn about, as the result of completing the game.

9.3.33 *Experiments*

Source: (Farr, 2016)

Adaptation: K. Becker

Original Idea: Experiments have been used in formal education for as long as most of us can remember. They help to answer what-if questions and facilitate hands-on demonstrations of principles and properties.

Game Strategy Adaptation: Games make excellent venues for experimentation. Students can go through the entire formal scientific process of forming a hypothesis, designing an experiment, carrying it out while collecting data (this can be done in pairs or teams), and then analyzing the results and drawing conclusions.

9.3.34 Fan Fiction

Source: K. Becker

Original Idea: Fan fiction is the creation of stories using settings and characters from existing fiction, film, television, or game. It requires a fairly thorough understanding of the world in which the original stories took place as well as an understanding of the existing characters. Fan fiction can take many forms, from writing episodes for a show or a prequel/sequel for a movie to creating entirely new stories using the existing setting and characters. Fan fiction can be expressed in almost any writing form available—including comics and graphic novels.

Game Strategy Adaptation: When applied to games it still requires that the game world and personalities of the characters be maintained as they were originally written. That's part of what makes it fan fiction. New characters can be introduced, but they should not change the spirit of the game.

9.3.35 Field Guides

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: A useful student project is to guide students in the creation of a field guide as would be produced and used by anthropologists, archaeologists, and naturalists. Field guides typically provide information that would be needed outside the classroom *in the field* in the study of such diverse fields as plants, animals, architecture, cultures, or business practices. Normal components of a field guide include: common names, formal names, definitions, graphic illustrations, explanations of the range (where you expect to find things), relevant dates, key facts, warnings, and "interesting notes."

Game Strategy Adaptation: When used in a game setting a field guide could be approached from two main perspectives:

1. As a guide to some region within the game's universe.
2. As a guide for a player *playing* the game.

In the second case the guide would still focus on a particular region of the game rather than the entire game unless the game is quite small. A field guide implies a certain format as well as certain kinds of content. This is used to guide the focus of the student while gaming.

9.3.36 Field Logs

Source: K. Becker

Original Idea: Field notes or logs are traditionally kept by people such as archaeologists, anthropologists, and naturalists when they are out in the field doing their work. They typically include written notes, comments, and reflections as well as sketches and maps.

Game Strategy Adaptation: When gaming, players can imagine themselves as observers or researchers in the field and make notes about their "time in the field" for later analysis, reflection, and comparison.

9.3.37 Field Trips

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: A field trip is any activity that occurs outside the classroom for the purpose of providing hands-on experience with objects or people that only occur in certain places.

Game Strategy Adaptation: A gaming session can be treated as though it is a field trip by creating the same kinds of pre- and post-trip activities one would normally create for a real life field trip.

9.3.38 Find the Fib

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: In the usual approach, groups of students write two true statements and one false statement, and then challenge other groups or even the teacher to "Find the Fib."

Game Strategy Adaptation: In the DGBL variant, the statements will come from the game. Many games take liberties with various aspects of reality in order to make the game more playable, intuitive, or entertaining. This strategy challenges players to find two things within the game that are true and one that is false. For example the relative sizes of some of the characters may not be to scale, or time might pass differently. There may be facts that are incorrect. This strategy is a way to go get students to think critically about what they are seeing and experiencing in the game, and it can also provide a way to highlight specific learning goals.

9.3.39 Find the Rule

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Normally, this strategy involves showing sets of examples that demonstrate a single rule (like "i before e except after c.") and asking the students to stat the rule.

Game Strategy Adaptation: In the DGBL version it can be used to uncover various aspects of the gameplay itself. Perhaps a challenge appears every time the player reaches a particular point or achieves a particular outcome. This strategy can be used to make players aware of the rule systems that are built in to the game. Depending on the game, these could overlap with real-world rules.

9.3.40 Flow Charts

Source: (Gilbreth & Gilbreth, 1921)

Adaptation: K. Becker

Original Idea: Flow charts are graphical depictions of processes or relationships that have been in use in engineering disciplines for nearly a century. Typically flow charts include icons showing particular processes or steps, and arrows indicating paths. Most include places where decisions must be made, and they outline the various pathways that can be followed depending on the decision made or the answer to the question asked.

Game Strategy Adaptation: In games, flowcharts can be used for a variety of purposes, such as to map out progress through a game, as a problem solving process, or to trace the “life” of a character through the game.

9.3.41 Game Box

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: A box of games kept in the classroom to be explored by students at their own pace.

Game Strategy Adaptation: In the DBGL context this will often be a virtual box rather than a physical one. It would include games that have educational value that students can learn from on their own or in small groups.

9.3.42 Game Club

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Many activities in formal education can be supported and enhanced by the creation of affinity groups (like clubs) in order to provide a way to support the activity outside of the classroom.

Game Strategy Adaptation: Game clubs can be formed or simply supported by the school for students to meet to discuss games. This can be an out-of-school group or one that is part of a classroom.

9.3.43 Game Kits

Source: (Dickerson, Clark, Dawkins, & Horne, 2006)

Adaptation: K. Becker

Original Idea: Science kits have been used in classrooms for a long time. They are meant to be self-contained and usually consist of a container that has specialized materials, tools, and apparatus for one or a small set of experiments or other activities. Lesson plans, teacher's guides, and worksheets and tests may also be included.

Game Strategy Adaptation: Inspired by the concept of Science Kits, a game kit contains various items. There are no commercially available game kits at this time that I know of, but until there is it is still possible for one or more teachers (perhaps with the help of students) to create a kit including tools and other items relevant to the game. They could be used to actually do some of the activities in real life that were done in the game (fingerprinting in a crime-scene investigation game for example). They could include additional artifacts from the environment of the game to be used to inspire creative writing or other activities.

9.3.44 Game Logs

Source: K. Becker

Original Idea: See #36 (Field Logs).

Game Strategy Adaptation: Game logs can be thought of as a specialized form of field log, only this one is a record of the player's progress through the game, including things learned, challenges met and overcome, and reflections on the gaming activity.

9.3.45 Game Pitch

Source: K. Becker

Original Idea: When developers approach a publisher with a game they want to make, they prepare a short presentation that is designed to convince the publishers to fund development. There are a number of fairly standard requirements for a game pitch, such as a hook to get them interested, a brief outline of the premise of the game and its distinguishing features among other things.

Game Strategy Adaptation: Students can prepare a game pitch, either as a high concept document or as a presentation as a way to summarize, review, and reflect on the game. This could be done before the game is played as an organizational or predictive activity or after.

9.3.46 Game Reports

Source: K. Becker

Original Game Strategy Idea: Adapted from the idea of being a book or film report, a game report is simply a factual, written summary of a Game. It may or may not include screenshots or other graphics.

9.3.47 Game Talk

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: A book talk in the broadest terms is what is spoken with the intent to convince someone to read a book. It differs from a book report in that it is intended to draw the listener in to the story by providing a glimpse into the story without spoiling it. It is similar to a movie trailer used to entice people to see a film.

Game Strategy Adaptation: A game talk is a variation on a book talk. It is not a game review or a game report or a game analysis. The game talker gives the audience a glimpse of the setting, the characters, and/or the major goals without giving away the ending or hints. Game talks are intended to make listeners care enough about the game to want to play it. A long game talk is usually about 5–7 min long and a short game talk is generally 30 s to 43 min long.

9.3.48 Guided Practice

Source: (Rosenshine, 1983)

Adaptation: K. Becker

Original Idea: Guided practice is a form of scaffolding. It allows learners to attempt things they would not be capable of without assistance. In the classroom, guided practice usually looks like a combination of individual work, close observation by the teacher, and short segments of individual or whole class instruction. In computer based or Internet based learning, guided practice has come to mean instructions presented on the learner's computer screen on which they can act. This action may be to perform some task using a program that is running at the same time, or it may be to interact with a simulation that is embedded in the program or web page.

Game Strategy Adaptation: When adapted to gaming, the instructions presented to the learner can either be part of the game itself if it is a game designed to be used for learning, or the can be created separately and presented to the students by the teacher live, or in a document as they play.

9.3.49 Independent Playing Programs

Source: K. Becker

Original Idea: Based on the independent reading programs, these are programs that allow students to proceed at their own pace through the game activities and then take assessments when they feel ready. An excellent example of an independent reading program is the SRA Reading Labs (Parker, 2013). They contain a set of short readings, each of which is accompanied by a guide and a post-test. The post-test score determines which set should be attempted next.

Game Strategy Adaptation: An independent playing program would have a variety of targeted gaming activities combined with similar guides and post-tests. Depending on the results of the post-tests, players could go on to the next level of activity or be required to continue in the same level of activity again.

9.3.50 Interdisciplinary (Cross-Curricular) Teaching

Source: (Farr, 2016)

Adaptation: K. Becker

Original Idea: Interdisciplinary teaching involves any effort on the part of the teacher to design learning activities with products and activities related to more than one discipline.

Game Strategy Adaptation: This is an approach that sometimes takes considerable advance planning, but can make a more involved game worth the time and effort required to learn how to play it and to justify extended gaming sessions.

9.3.51 Journal

Source: (Farr, 2016)

Adaptation: K. Becker

Original Idea: Journaling is a well-accepted practice in many classrooms now. It involves creating regular entries that are specific to a particular context. They can be for general learning reflections, subject based, or activity based.

Game Strategy Adaptation: When connected with game-based pedagogy, it can be a way to reflect on gaming experiences throughout the year and be a journal of all gaming experiences, in and out of school or it can be specific to just one game.

9.3.52 Justifying

Source: (Farr, 2016)

Adaptation: K. Becker

Original Game Strategy Idea: Even though many games appear to have unlimited choices, none actually do, and often they have only two or three choices at any given point in the game. This strategy asks players to become conscious of the choices they make in the game and asks them to explain why they made the choice they did and then to reflect on the outcome of that choice. One of the advantages of a game is that it is often possible to go back to the same decision point and try an alternate decision, either by back-tracking, by playing the game to that point again from the previous *save point*.

9.3.53 Knowledge Rating

Source: (Farr, 2016)

Adaptation: K. Becker

Original Idea: This is a reading strategy where students skim a reading and select words from the reading. They then rate the words based on their familiarity with them.

Game Strategy Adaptation: When applied to gaming students can be asked to generate lists of words collectively based on their knowledge of the game they are about to play and their current understanding of the topic(s). Teachers can also give students preselected words to rate.

9.3.54 KWHL

Source: (Angelo & Cross, 1993)

Adaptation: K. Becker

Original Idea: This is a strategy described by Angelo and Cross (1993), and adapted by Debble Blaskowski, a fourth-grade teacher at the Weyerhaeuser School in Weyerhaeuser, Wisconsin (North Central Regional Educational Laboratory, 1995). It is a chart that is begun before the activity and then revisited afterwards. The chart consists of four columns:

K = Know—What the student already knows about the topic.
W = Want to know—What they want to find out.
H = How to find out—a strategy for how they will find out.
L = Learned—post-activity refection summarizing what they learned.

Game Strategy Adaptation: This strategy can be applied as is directly to a gameplay session. It can be applied both to the learning objectives in the game and to the game itself. When applied to the game itself, it can serve double duty as a kind of play plan which could also be used as a guide by others.

9.3.55 Learning Contracts

Source: (Farr, 2016)

Adaptation: K. Becker

Original Idea: A learning contract is a personal agreement between the teacher and a student outlining the student's plan for achieving the desired learning outcomes. It can also outline options and alternatives offered by the teacher and the requirements for their implementation.

Game Strategy Adaptation: There are at least two ways to use learning contracts with DGBL:

1. To help contextualize and focus play within the game.
2. To create individualized learning paths in the game.

9.3.56 Learning Stations

Source: (Farr, 2016)

Adaptation: K. Becker

Original Idea: These are individual stations where individual or paired students can explore resources that are designed to extend knowledge introduced during whole group instruction.

Game Strategy Adaptation: Like the Game Box (#41), this can be done in a way that allows for "stations" to be virtual, perhaps as specific folders accessible by computer or mobile device. The difference is that rather than being game-specific, these are topic-specific and may include multiple topic-related games as well as other resources.

9.3.57 Letters from Previous Players

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: This is an adaptation of the "Letters from Last Year's Class" idea. In the original version students write letters at the end of the year for future students. In our variation students will write letters to the next group of players of a particular game. Normally these letters include tips, but in this case it is important to avoid actual spoilers. Other than that, these letters can include highlights from the students' experiences in the game, new concepts they have learned, pitfalls to avoid.

Game Strategy Adaptation: The letters are meant to be shared with the next group of players before they begin to play. These letters can also be used to build or augment existing teacher guides.

9.3.58 Machinima

Source: K. Becker

Original Idea: Machinima is a form of filmmaking using games. They are effectively plays that take place inside a video game rather than on a stage. They can be simple and last a minute or so, or they can be quite involved. Machinima involves considerable additional challenges that are not part of the creation of film from scratch as the settings and actions of the characters are limited. It is common to overlay audio that has been specifically created for the purpose, but the movements and scenes are usually those that can and do exist in the game "naturally."

Game Strategy Adaptation: Machinima can be used as a form of creative writing or film-making but it can also be used to create informative videos that demonstrate concepts or discussion points. Due to the inherent limitations, machinima can be quite challenging to produce. At the lower elementary levels it may not be practical, but there are still many games that have sandbox modes or that are effectively open worlds (like *Minecraft*) where the creation of machinima is still possible.

9.3.59 Muddiest Point

Source: (Angelo & Cross, 1993, pp. 148–153)

Adaptation: K. Becker

Original Idea: The muddiest point is a question used to stimulate metacognitive thinking, based on the original idea of the One-Minute Paper (Angelo & Cross, 1993). A one-minute paper is a rapid feedback technique used to help students focus their reflection on key points. In the muddiest point, students are asked to name or describe the concept they understand the least (their muddiest point).

Game Strategy Adaptation: This can easily be applied to gaming directly, but can also be adapted to focus on such things as decision points within the game or challenges within the game they met by accident (such as through random clicking) rather than through learning and deliberate choices.

9.3.60 Olympiads

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Olympiads are formally regulated contests used to stimulate interest and enthusiasm for a particular topic.

Game Strategy Adaptation: While many games have built-in contests and competitions, it is always possible to impose one from outside of the game that are designed to help students play in a more targeted way or to highlight the desired learning outcomes.

9.3.61 Pair Play or Team Play

Source: (Williams, Kessler, Cunningham, & Jeffries, 2000)

Adaptation: K. Becker

Original Idea: Pair programming is a strategy that has been practiced in software industry for years. It is the practice of two programmers working side by side at one computer on the same problem. This is not meant to be a mentorship or supervision and programmers are typically evenly matched as far as skill and expertise goes.

Game Strategy Adaptation: This idea can be adapted to gaming in the classroom by having two students sitting together playing the same instance of a game. It is a way of pooling joint knowledge and support through the game. Team play is simply pair play with a few more people.

9.3.62 Paired Annotations

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: An extension of Pair Play (#61) has students pair up to review/learn using the same game (not necessarily using pair play but normally playing at the same time) and then exchange double-entry journals (#30) for targeted gaming and reflection. Students discuss key points and look for divergent and convergent thinking and ideas.

Game Strategy Adaptation: Together students prepare a composite annotation that summarizes the key learning they have gleaned from playing the game.

9.3.63 Playing Out Loud

Source: (Young, 2007)

Adaptation: K. Becker

Original Idea: This is a strategy where students are asked to say out loud what they are thinking as they complete an activity. This could a reading exercise, math problem, research, or any other activity.

Game Strategy Adaptation: Adapted from the think-aloud strategy, this is a thinking out loud technique that asks players to try and think aloud as they play; including the questions they ask themselves, the alternate approaches they consider, and their reactions as they progress through a game. It is an approach that fosters conscious gaming.

9.3.64 Portfolio

Source: K. Becker

Original Idea: Portfolios are a well-established assessment technique in the arts. Portfolios are carefully selected samples of student work accompanied by formal criteria to allow the reader to judge the materials in the portfolio. Portfolios typically include work selected by the student to show their best work, some pieces to show progress, and other work that reflects on what was learned and what remains to be learned.

Game Strategy Adaptation: These can be used in gaming to showcase the work students have done both in the game and with the game.

9.3.65 Position Paper

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: A position paper is a form of writing in which students take a position on some issue, then use information from one or more sources to support that position.

Game Strategy Adaptation: Students can be asked to describe a position taken by an in-game character or even by the game itself. What is the message of the game? Does it take a particular moral stance? Here the sources can be both in-game and outside, depending on what the teacher is trying to achieve.

9.3.66 Possible Dialog/Possible Statements

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: This is a form of advance organizer that uses a vocabulary list to help students prepare for a reading or other activity. The vocabulary words are used to create sentences that relate to the content or process of the activity.

Game Strategy Adaptation: A pre-gaming strategy in which students are presented with vocabulary words from the game. Students choose pairs of vocabulary words and use these two words to write sentences that may appear in the game, either as dialog or elsewhere. After the game students evaluate the correctness of their sentences, and sometimes correct them.

9.3.67 Precision Playing

Source: (Lindsley, 1992, p. 51)

Adaptation: K. Becker

Original Idea: Precision teaching is defined as, "basing educational decisions on changes in continuous self-monitored performance frequencies displayed on 'standard celebration charts.'" It is a way to plan and adjust instruction based on the student's own measurement of their progress.

Game Strategy Adaptation: When this is applied to gaming, it involves deliberate targeted play focused on improving specific learning goals. Play can either be directed individually or under the teacher's guidance.

9.3.68 Predictions

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: This is a straight-forward strategy where students prepared for an activity such as reading a story or performing an experiment by getting them to make predictions about what they expect to happen.

Game Strategy Adaptation: Students make predictions about what is going to happen in the game, either as a direct result of their interactions or as part of the game's predetermined actions to indicate their understanding of concepts. These predictions can then be assessed after the game.

9.3.69 PROP Advance Organizer

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: A PROP is an advance organizer created by the teacher. It is a structured format to give students an overview of what to expect from upcoming activity. Using a completed form, the teacher describes for students:

P = Prior knowledge—what they should know (key knowledge and key questions to consider).
R = Relationships—between key characters, concepts, situations (including key terms).
O = Organization—how to organize the ideas for the activity..
P = Plan—the basic plan of the lesson.

Game Strategy Adaptation: This strategy can be used as is to help students connect what is learned in the game with the real world. The questions asked are intended to help the students focus on the learning goals during their gaming session.

9.3.70 Question the Developer

Source: (Beck, 1997)

Adaptation: K. Becker

Original Idea: This is a variation on the Question the Author strategy, where readers select a specific passage and attempt to answer question developed by the teacher in order to gain a deeper understanding of the text and/or the approach.

Game Strategy Adaptation: When we do this in DGBL, we can generalize our target to developer, even though in games the design is very often a team effort. A specific set of interactions or part of a level is selected, and students are prompted by questions such as: What is the message the developer is trying to deliver? Why do you think they are giving you this particular set of choices? or How does this part of the game fit in to the larger message? What kinds of questions will be appropriate will depend on what kind of game it is.

9.3.71 Recall, Summarize, Question, Comment, and Connect (RSQC2)

Source: (Angelo & Cross, 1993)

Adaptation: K. Becker

Original Idea: This is a structured summarization technique in which students:

R = Recall (list) key points. These are points the student found most significant. These points should then be ranked in order of importance.
S = Summarize each point from the last step in a single sentence.
Q = Note one or two *questions* that remain unanswered.
C = Connect the material to the goals of the activity.
C = Write an evaluative *comment* or two, such as what was most/least helpful.

This technique can be applied to any activity, from a reading to an entire semester.

Game Strategy Adaptation: The focus for this activity when applied to a game is to get the students to think about the things they learned from the game that connect with the learning objectives.

R = List the key points (from a learning perspective) from the gaming session and rank them.
S = Summarize each of the key points above in a single sentence.
Q = What is one question about the game and one question about what you were to learn that remain unanswered?
C = Connect the game to the goals of the course.
C = What did you like most/least about this game activity?

9.3.72 Reflection Logs

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Reflection logs are a fairly generic term for any diary, log, of blog that the student uses to record ideas and thoughts about a learning activity. These can be public or private, depending on school policies, and they can either be specifically directed to include reflections directly connected to the learning goals or they can be broader in scope.

Game Strategy Adaptation: In this case the reflection should focus on the gameplay and the learning that the student accomplishes. As a reflection log it is meant to record reactions and subjective thoughts about the game and the gameplay. It could include gameplay strategies or tangential notes. There are no right or wrong answers here, but this could be used by the teacher to gain insight to possible misunderstandings on the part of the student.

9.3.73 RELATE Table

Source: ("Making Real-World Connections When Teaching Major Concepts in Inclusive Classrooms | LD Topics|LD OnLine," 2016)

Adaptation: K. Becker

Original Idea: This is a guided approach to reflecting on a concept to help students connect a concept to what they already know.

R = Reveal the essential concepts, i.e., those ideas that are central to understanding the lesson or unit.
E = Evaluate the concept relative to its value in today's society.
L = List examples.
A = Analyze actions. This asks what current society has done to either promote or inhibit this concept in today's world.
T = This idea is like…. This element asks the student to create a metaphor or simile for the concept.
E = Explain an experience of knowledge connection. This intended to identify specific connections to individual students' background knowledge or experience.

Game Strategy Adaptation: Given that some games can have fanatical themes this strategy provides a way to a help students connect what they learn in the game with real-world events. It is much like a concept map only it takes concepts, ideas, and events from the game and relates them to real-world concepts, ideas, and events.

9.3.74 Relay Summary

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: A relay summary is a way to create a summary of a story or other lesson by having each student, in turn, write one or two sentences of the summary before passing the document on to the next student. This can be done with an entire class or with smaller teams. If done with an entire class and the end of the summary is reached before all students have contributed, it is possible to start at the beginning again to fill in additional details.

Game Strategy Adaptation: In some games players will have individual experiences when playing the same game so creating a relay summary can be used to prompt reflection and discovery. In a relay summary students take turns retelling the story of the game they have played. Each person writes one or two sentences before passing the document on to the next person. This can be done with teams who have played the same game collaboratively or with students who have played individually.

9.3.75 Retelling the Story

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: This is a form reading or other lesson comprehension. One way to approach this is to tell the story in the form of a folk-tale.

Game Strategy Adaptation: In the game version the student can write the narrative or the interactions of the game they just played. This can also be completed as a group activity.

9.3.76 Rewrite the Ending

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: This is a fairly common approach used in creative writing. It is also used to help students recall and consider a story in order to assist comprehension. The basic idea is to consider a story and imagine how it might change if an alternate ending were considered.

Game Strategy Adaptation: This applies to games with a definite narrative. It can be used both for creative writing as well as a way to examine the game scenario from other perspectives. Some games already provide for multiple end games and these could be explored using either the predetermined *end games*, or by having the students create alternate end games.

9.3.77 Role-Playing

Source: K. Becker

Original Idea: Role-playing has a long history in formal education and is a key feature of many educational simulations (Becker & Parker, 2011). It is a form of case study where the "story" is not decided ahead of time, merely the roles that participants will play, which creates possibilities and constraints that can be very useful.

Game Strategy Adaptation: This one should be an obvious one and is an easy match with games. Role-play can be enacted in the game or outside of the game.

9.3.78 Role/Audience/Format/Topic (RAFT)

Source: (Santa, 1988)

Adaptation: K. Becker

Original Idea: This is a post-reading activity in which students demonstrate their understanding by writing for a specific audience. Each of the four elements is addressed specifically in the kind of writing that is done. The four elements are:

R = Role of a writer. Who is going to be the writer of this piece?
A = Audience: To whom is this written?

F = Format: What form will the writing take?
T = Topic; The topic of the writing is paired with a strong verb to describe the nature of the approach, such as plead, convince, halt, stop, create, etc.

Game Strategy Adaptation: This is a post-gaming activity in which students demonstrate their understanding by writing their reflections or take-aways from the game session for a specific audience.

9.3.79 S.W.O.T. Analysis (SWOT)

Source: (Humphrey, 2005)

Adaptation: K. Becker

Original Idea: SWOT is a structured planning method that guides the Analysis of

S = Strengths
W = Weaknesses
O = Opportunities
T = Threats
(SWOT) in a situation

Game Strategy Adaptation: Can be used as a way to approach challenges in the game.

S = Strengths: What are the strengths of the character in the situation or of the items that the player has access to?
W = Weaknesses: In what ways is the character weak, or what are the weaknesses of the tools the player can use?
O = Opportunities: What knowledge, skills, or properties of the opponent, environment, or situation could be exploited to the player's advantage?
T = Threats: Who or what could cause trouble for the player and interfere with the player's ability to achieve their goal?

9.3.80 Scale Models and Drawings

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: The idea of creating scale models or drawings of some aspect of the lesson being learned has been around long enough that its origins are lost in antiquity. The basic idea is to create a model of some item related to what is being studied, or a map, or even a diorama of some sort.

Game Strategy Adaptation: The same idea can be applied to create images or three-dimensional models of spaces that exist in the game. They can serve to help students develop various mathematical and special skills in and of themselves, but they can also be used as a way for students to simulate the game and try out various scenarios without using the game. This can be useful if access to the game is limited due to lack of resources or large classes, but it can also be a way to explore beyond the bounds of the game.

9.3.81 SCAMPER

Source: (Michalko, 2014)

Adaptation: K. Becker

Original Idea: Creativity technique that uses the SCAMPER acronym to help students remember to try many variations on an idea. They are intended as starting points to prompt ideas.

S = Substitute
C = Combine
A = Adapt
M = (Modify, Magnify, Minify)
P = Put to other use
E = Eliminate
R = (Reverse, Rearrange)

Game Strategy Adaptation: This is a structured approach that can be used to apply to any project that is related to the gameplay, but it can also be used specifically to progress through a game when players get stuck or as a way to attack puzzles that need to be solved within the game.

9.3.82 Screenshots

Source: K. Becker

Original Game Strategy Idea: Some games allow players to create screenshots as they play and others don't, but most mobile devices have mechanisms for taking screenshots. Laptops and desktops have built-in applications for taking screenshots, but there are a host of third party applications that can be used, many of which also support video capture. This can be used to record in game activity for later use or to supplement any of the other strategies that require the players to record or annotate their play.

9.3.83 Self-Selected Gaming

Source: K. Becker

Original Game Strategy Idea: Students select the goals they will pursue in the game. This can improve motivation because students can select those parts of the game of interest to them. These goals can be ones that are directly related to the game, or ones that have been created by the teacher. This can be organized in a wide variety of ways, from having a single list of goals and allowing each student to choose one to providing categories of goals and requiring students to choose one from each category. However this is done teachers must of course ensure that all students have at least some opportunity to be among the first to choose.

9.3.84 Send-A-Problem

Source: (Barkley, Cross, & Major, 2005)

Adaptation: K. Becker

Original Idea: Send-A-Problem is a two stage group approach to problem-solving. In the first phase each group receives a problem to solve and attempts to solve it, recording their efforts. They then pass it on to another group who also tries to solve it, but without looking at what the previous groups have done. This allows the groups to brainstorm without being influenced by what others have done. In phase two, all of the solutions are examined and discussed so they can learn to compare and discriminate among multiple solutions.

Game Strategy Adaptation: When applied to games, each group will have some problem to solve or task to complete within the game. Each group plays the game and attempts to solve the problem or complete the task, making notes of what they have done and how it turned out.

9.3.85 Shared Gaming

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: This is a strategy adapted from the shared reading idea, which normally uses oversized picture books from which the teacher reads aloud to a group of children.

Game Strategy Adaptation: In shared gaming the teacher uses a large monitor or data projector to project the game for the entire class and the whole class plays as one. This can make it possible to use a game in the classroom that otherwise could not be used due to a lack of funding or resources. It can also be used in a situation where the subject matter is in some way sensitive, requiring direct supervision during play. It is also useful with COTs games where the teacher wishes to direct the gaming in a particular direction, either to avoid having students go off and play in places or ways that are counter-productive to the learning objectives.

9.3.86 Shadowing

Source: (Rowan, 2013)

Original Idea: The student follows a professional for several hours or a whole day to learn more about the work done by, and skills needed by that person. This is often used in teacher education programs or apprenticeships.

Game Strategy Adaptation: It can be adapted to game-based pedagogy by having a student pretend to shadow a professional character in a game by paying attention to the aspects of that character that represent actions related to the specific profession. This can also be done in a multiplayer game by having a student shadow a player of a higher rank.

9.3.87 SOAPSS

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: This is a method to encourage consideration of the context in which a particular piece of writing was created.

S = Subject
O = Occasion
A = Audience
P = Purpose
S = Speaker
S = Style

Game Strategy Adaptation: It can be adapted to game-based pedagogy by applying it to a particular game sequence, level, or quest in the same way as it would normally be applied to a short story, chapter, scene, or single passage.

9.3.88 Storyboards and Story Maps

Source: (Davis, 1993)

Adaptation: K. Becker

Original Idea: A storyboard is a set of pictures that shows the progression of actions in a film or animation. They can help students highlight the key scenes or events in a story. A story map is a strategy that uses a graphic organizer to help students learn the elements of a book or story. It could be an actual map where the characters and events are noted by their location in the story's world, or it could also look more like a concept map

Game Strategy Adaptation: This is clearly applicable to any game that includes a narrative, but can also be used to map out the interactions in a game that lead to the desired learning outcomes.

9.3.89 Structured Learning Team Group Roles

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: This is an approach to building teams that has them take on specific roles with defined identities. Possibilities include:

- Leader—The leader is responsible for keeping the group on the assigned task at hand.
- Recorder—The recorder looks after the group's files and other documents and may also keep track of who does what when.
- Reporter—The reporter gives oral or written responses to the class about the group's activities or conclusions.
- Monitor—The monitor is responsible for making sure that the group's work/game area is left the way it was found and acts as a timekeeper for timed activities.
- Wildcard (in groups of five)—The wildcard can assume the role of any member that may be missing, and may assist anyone who needs it.

Game Strategy Adaptation: This can be applied to game-based learning as a way to structure groups working on a project involving the game. It can also be adapted to make use of Bartle's player types (1996) as a way to influence styles of play. The results of playing from the point of view of a specific role can then be considered either from the perspective of what happened in the game or from the perspective of the player. Bartle described four basic player types as a way to explain how people approach gameplay:

1. *Achievers* are interested in doing things to the game. They wish to affect the game world in some way.
2. *Explorers* are interested in having the game surprise them. They interact with the world and want to see what it does.
3. *Socialisers* are interested in interacting with other players.
4. *Killers* are interested in doing things to people.

Most players adopt all of these roles at various times, but playing a game from the perspective of a particular role can sometimes result in interesting insights.

9.3.90 Supervised Practice

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: Supervised practice has long been an integral part of apprenticeship models of learning. In a classroom setting, it involves someone with greater expertise, often but not always the teacher, observing and assisting in a one-on-one setting.

Game Strategy Adaptation: The game oriented version involves having the student work through all or part of the game with the teacher, mentor, or some other guide sitting next to them or looking over their shoulder as they play. The supervisor can help the player keep from getting stuck, or keep them on task, or help to prompt them to problem solve when they get hung up. Ideally, the supervisor will help the gamer by asking questions or indirect suggestions rather than simply telling the gamer what to do, but in some cases simply telling the gamer what to do can be appropriate.

9.3.91 TAPPS (Thinking Aloud Pair Problem Solving)

Source: (Lochhead & Whimbey, 1987)

Adaptation: K. Becker

Original Idea: This is a collaborative problem-solving technique that was introduced by Lochhead and Whimbey (1987) as a way to help make problem-solving skills more conscious by verbalizing to a listener one's thoughts on problem-solving as they are happening. In TAPPS, two students work cooperatively on a collection of short problems. Each student has a definite role: one student is the problem solver. The student reads the problem and then tries to say what they are thinking as they attempt to solve the problem. The other student is the listener. Their job is to make sure the problem solver keeps talking. The listener is trying to understand the path taken to solve the problem and the reasoning behind it.

Game Strategy Adaptation: This strategy can work especially well with students who may not be as adventurous in their gaming as others. Working in pairs and verbalizing their thoughts as they are happening can help both members of the pair.

9.3.92 Teams-Games-Tournaments (TGT)

Source: (De Vries & Slavin, 1978)

Adaptation: K. Becker

Original Idea: This is a more structured form of competition (#19) where students can play in teams who then compete against other teams. It is intended to promote cooperative learning. The initial teams are formed with the goal of helping each other learn the material they are to learn. Once that is done, then the game tournaments are organized. This involves assigning three students to a table so that each table has no more than one member from any original team. Games are typically simple quizzes consisting of numbers on cards that correspond to questions. A student picks a number card and attempts to answer the question corresponding to the number. A challenge rule permits players to challenge each other's answers. The tournament is the structure in which the games take place. It is usually held at the end of a unit after students have had a chance to become familiar with the material. For the first tournament, the teacher assigns students to tournament tables—assigning the top three students in past performance to Table 1, the next three to Table 2, and so on to equalize the competition at each table.

Game Strategy Adaptation: As usual, this strategy can be applied to content learned within the game. Alternatively, the *game* can be something that is dome inside the game that is part of the lesson. Rather than simply asking content questions, challenges from within the game can be used. In the team phase, students will play together in order to learn how to meet the challenges in the game (collect *loot*, finish a level, etc.). The tournament part can then consist of numbered challenges, and the players at each table must meet the challenge. Depending on the game, this could require the ability to save the game at various points so that the specific challenge can be attempted without having to play from the beginning.

An alternate variation would have students work through the challenges in a specific order rather than choosing a number.

9.3.93 Through the Eyes of the Enemy

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: This is a strategy meant to help students consider alternate perspectives and gain empathy by trying to view the situation through the eyes of the antagonist in the story.

Game Strategy Adaptation: Games are especially good at facilitating this kind of strategy as it is often possible to play "as the bad guy" in a game and this can lead to interesting insights. Even when that is not possible, in a game that has an antagonist it is possible to explore how the interaction might look from the perspective of the antagonist.

9.3.94 Value Line

Source: (Rowan, 2013)

Adaptation: K. Becker

Original Idea: The basic idea here is to present opposing answers to some question or issue, and place these answers at opposite ends of a labeled line, similar to a Likert Scale. Classes are usually broken up into small groups whose members position themselves along the line to reveal their opinions on particular topics. Then group organizers create new groups by assigning members to either heterogeneous or homogeneous groups based on those opinions or answers.

Game Strategy Adaptation: There are a variety of ways this strategy can be used in DGBL.

The question or issue can be one that connects directly to the learning objectives, but it can also relate to the way the students are playing and how different approaches affect what they are taking away from the game.

9.3.95 Video

Source: K. Becker

Original Game Strategy Idea: Video can be used as a means of expression for the student but it can also be used as a way of recording the students' interactions in the game to uncover places where they are struggling. It can be used as a way to present a story, concept, or a project. When used to record students' interactions, it can be used to analyse behavior and help students become more mindful of their learning.

9.3.96 Walkthroughs

Source: K. Becker

Original Idea: In video games, a walkthrough is a detailed description of the steps required to play through a game from start to finish. People often use these when they become stuck in a game to help them get past a particular point and go on with the game.

Game Strategy Adaptation: A walkthrough can be a useful way of documenting the students actions in a game, but it can also be used to create demonstrations of part or even all of a game. When used in the second way, they can be of value to other students in the class who are having difficulties, but they can also be useful for other teachers who may be less familiar with the game but may still want to be able to use it with confidence.

9.3.97 What Would/Should X Do? (WWXD or WSXD)

Source: (Zeidler, 1990)

Adaptation: K. Becker

Original Idea: This approach was developed as a way to consider moral perspectives and value implications in science education. It is a strategy to get students to consider and justify their responses so as to reveal the logic behind their reasoning.

Game Strategy Adaptation: This strategy is a way to get players thinking more about the characters in the game from the perspective of their principles and world views. The exercise involves considering an activity, or problem from the perspective of a specific character from a game rather than their own or that of the instructor. The activity or problem should be related to the learning objectives, but need not be directly related to the game.

9.3.98 Who Am I? Why Am I?

Source: K. Becker

Original Game Strategy Idea: In a game where players can take on particular characters or enact various personalities, this approach asks them to consider and explain their game character. They are to answer questions such as:

- What are your character's strengths and weaknesses (including powers and tools)?
- How do these strengths and weaknesses help your character achieve the goals that have been set out for you?

9.3.99 Working Backwards

Source: (Scardamalia & Bereiter, 1985)

Original Idea: This is a form of problem solving where we start from the desired solution and try to work backwards to our current position. It often helps to ask various questions, such as: What information is relevant here? Might there be potential credibility or bias problems? What about logistical problems? Could this really have happened?

Game Strategy Adaptation: This can be useful in pathfinding in a game as well as in solving various puzzles or completing quests. If players consider the problem by starting at the end, it sometimes yields insights that simply moving forward doesn't.

9.3.100 Writing

Source: K. Becker

Original Game Strategy Idea: There are of course, countless ways for students to write in connection with a game. Ideas include creative writing, extending the game, exposés, conversations, letters, etc. Students can write game reports in a style similar to book reports; they can write fan fiction; they can create hypothetical dialogs between characters in the game or a letter to or from a character in the game, or even between characters within the game. Almost any game could be used for a writing exercise. Even a game that really has little in the way of narrative, such as *Angry Birds* could be used in this way. Students could be asked to write the back story for this game. Why did the pigs steal the birds' eggs? What are they planning on doing with them? Where are their own babies?

9.3.101 YouTube

Source: K. Becker

Original Game Strategy Idea: YouTube can be used as a showcase for a wide variety of things, such as:

- Game walkthroughs where students explain how what's happening in the game relates to their learning objectives.
- Interviews (staged or real) with game characters, personalities, etc.
- Mash-ups and machinima.
- How-to videos to explain how to play the game.

We now have quite a long list of strategies using games that we can try out in our lessons. These can be used directly, but they can also be used as inspiration to help you create even more. They can be adapted and switched around, and you may even find that seeing how some of the established strategies can be adapted for use with games will suggest ways you can adapt some of your own favorite strategies. Finding ways to make games a natural part of a lesson rather than an add-on can go a long way towards making your lessons authentic, meaningful, and fun.

9.4 Summary

In this chapter we get down into the trenches and look at a number of ways to actually use games in the classroom and the instructional strategies that can be employed. There are many different ways to use games in the classroom. The games we use do not always need to meet learning objectives directly, but if they don't it means we have to design our lessons to make sure that the necessary dots are connected. Creating well-thought out lesson plans can help us do that. That's next.

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Chapter 10
Creating DGBL Lesson Plans and Curricula

There are some things you learn best in calm, and some in storm.

Willa Cather (1915)

At A Glance
This chapter takes what we've learned up to this point and builds a template for lesson plans that make use of games. It starts with a fairly standard lesson plan template, adapts it for use with a game, and develops several lesson and unit plans using that template.

The lesson plans make use of the game analyzed in the previous section: Real Lives; Ossy Osmosis; Going Home; Minecraft.

Since some of these games are less than perfect, it will provide an opportunity to show how to take advantage of what a game has to offer even if it isn't perfect.

Ways to use games:

- As inspiration
- As a lesson opener
- As homework (background; lesson prep)
- As the lesson

For the medium scale and semester long plans, we switch to a different format that is a little more generalized.

Lastly, we discuss the use of games over a longer period of time, such as an entire semester or even multiple semesters. We consider what we learned from creating the lesson plans in the earlier sections and discusses how one might plan for extended use, not unlike studying a novel or using a textbook over a whole course.

K. Becker, *Choosing and Using Digital Games in the Classroom*, Advances in Game-Based Learning, DOI 10.1007/978-3-319-12223-6_10

Chapter Goals

- Identify the key elements of a game lesson plan.
- Consider how to make the best possible use of a less-than perfect game for learning.
- Develop templates for lesson, unit, and long-range plans.

Key Terms

These are the terms introduced in this chapter. Definitions for these terms can also be found in the glossary.

- Differentiated Instruction
- Individual Education Program/Plan
- Lesson Plan
- Objectives (Learning)
- Outcomes (Learning)
- Unit Plan
- Universal Design for Learning

10.1 Introduction

How do we design a lesson that uses a game? We already know we want to create a lesson plan, but it can feel a little like having a paintbrush in your hand and staring at a blank canvas, so, where should we start? Usually, we will start with something we want or need to teach and, given that this is a book about choosing and using digital games, let's also assume we want to use a game. While we may have a number of games to choose from, it is far more likely that by the time we get to lesson planning we will have a game already picked out, either because we've played it ourselves, or because it was recommended to us by someone we trust, or as a result of something like the 4PEG analysis. From Part Two of the book we learn some tools and techniques for evaluating that game, so we already have a pretty good idea about its strengths and weaknesses. We look at instructional design models in the last chapter so we also have a number of guides we can use for our design process, but they don't tell us how to create a lesson plan. When designing something as complex as a lesson, it's often helpful if we have a relatively standard template we can use to guide us in designing our finished product. That's where the lesson plan template comes in.

10.2 Lesson Plans for Games

Ideally, when we design our lesson plans for a course, we begin from the outside and work our way in. In other words, we start at the highest level in the hierarchy shown in Fig. 8.1 that applies to us. It is not often that as teachers we are given a great deal of freedom over what to teach. Whether at the national, state, or local board level, we will likely have been told what we need to teach, at least in general terms. However, many mandated curricula are still relatively vague. The following is an example from Canada where each province has a standard curriculum that teachers must follow.

This one is from the Alberta Grade 3 Social Studies curriculum. The topic is Communities in the World (Alberta Education, 1996).

3.1 Communities in the World

General Outcome

Students will demonstrate an understanding and appreciation of how geographic, social, cultural and linguistic factors affect quality of life in communities in India, Tunisia, Ukraine and Peru.

Specific Outcomes

Values and Attitudes

Students will:

3.1.1 Appreciate similarities and differences among people and communities:

- Demonstrate an awareness of and interest in the beliefs, traditions and customs of groups and communities other than their own (CC)

Knowledge and Understanding

Students will:

3.1.2 Examine the social, cultural and linguistic characteristics that affect quality of life in communities in other parts of the world by exploring and reflecting upon the following questions for inquiry:

- What determines quality of life? (CC)
- How does daily life reflect quality of life in the communities (e.g., employment, transportation, roles of family members)? (CC, ER, GC)
- How does access to public services affect the communities? (e.g., schools, hospitals, libraries, transportation systems)? (ER, GC, PADM)
- What are the traditions, celebrations, stories and practices in the communities that connect the people to the past and to each other (e.g., language spoken, traditions, customs)? (CC, GC, TCC)
- How is identity reflected in traditions, celebrations, stories and customs in the communities? (CC, I, TCC)
- How are the various leaders chosen in the communities (e.g., within families, within schools, within communities, within government)? (GC, PADM)
- How are decisions made in the communities? Who is responsible for making the decisions? (CC, PADM)

- How do the individuals and groups in the communities maintain peace? (GC, PADM)
- How do the individuals and groups in the communities cooperate and share with other group members? (C, CC)
- How is cultural diversity expressed within each community? (CC, I)

3.1.3 Examine the geographic characteristics that shape communities in other parts of the world by exploring and reflecting upon the following questions for inquiry:

- Where, on a globe and/or map, are the communities in relation to Canada? (LPP)
- In what ways do the people in the communities depend on, adapt to and change the environment in which they live and work? (ER, LPP)
- In what ways do the communities show concern for their natural environment? (GC, LPP)
- How does the physical geography influence the human activities in the communities (e.g., availability of water, climate)? (CC, LPP)

3.1.4 Examine economic factors that shape communities in other parts of the world by exploring and reflecting upon the following questions for inquiry:

- What are the main goods and services produced by the communities studied (i.e., agricultural activities, manufacturing activities)? (ER, GC)
- What goods and services do the communities import from and export to other parts of the world? (ER, GC)
- What are the main forms of technologies, transportation and communication in the communities? (ER, GC)

Note: The letter codes in brackets refer to various strands of social studies that all levels of the curriculum should connect with. These are: C Citizenship; I Identity; ER Economics and Resources; LPP The Land: Places and People GC Global Connections; CC Culture and Community; PADM Power, Authority and Decision Making; TCC Time, Continuity and Change

This description uses *outcomes* to describe what is wanted from the lessons that address this topic. There really is no general agreement on the distinction between outcomes and *objectives* and many use the terms interchangeably. The distinction we will make here is that the outcomes are from the learner's point of view (what the students will do) and objectives are from the teacher's point of view (what the teacher will do).

Let's suppose that this description of outcomes is our starting point.[1] From here we can build a lesson plan. We will use this set of objectives in the next section when we create some lesson plans, but first we need to know what goes into a lesson plan.

[1] If this is not your starting point, then your first step is to create a general curriculum guideline like the example shown.

10.3 Anatomy of a Lesson Plan

As teachers, we all know that *Lesson plans* help us to structure the activities supporting particular topic(s) or objectives in class. The point of a lesson plan template is to provide a guide that can be used when planning lessons. The plan may be adapted and modified as necessary but an effort should be made to fill in all parts. It should be filled out in sufficient detail that another teacher could use it. Although lesson plans can come in many different forms, this one is adapted from the Lesson Plan Template document created by the faculty at the Thompson Rivers University Bachelor of Education program (TRU Education Faculty, 2015a). Each of the sections is listed and explained. We use this template to develop several sample lessons in the next section. There is a blank lesson plan template in the supplementary materials section of the book.

The beginning of the lesson plan should include some administrative information such as a title, which lesson it is and if it is part of a sequence or set, the date for tracking revisions, the name of the author, which game you are using, and the grade and subject. This is followed by a number of distinct sections, each of which addresses a different aspect of the lesson. It is not necessary to fill in the lesson plan in any particular order, except for the initial parts.

Rationale and Overview

The rationale explains reasons for teaching this particular lesson and serves as a brief overview of the lesson. The rationale should be a brief sentence or two and stated in words that can be easily understood by the children in the classroom. This part should be filled out first as it will drive the rest of the lesson plan.

- Is it part of a complex skill?
- Is it something they need to master before going on to something else?
- Are you trying to introduce a concept or consolidate a skill such as practice estimating and calculating trajectories?
- In what way does the game help address the need?

Learning Outcomes

Your lesson should state one or more prescribed learning outcomes, such as those from the approved curricula from your local board, district, or state, on which the objectives of this specific lesson are based. If there are more than three that apply, choose the three most significant ones. You may list others as secondary. This helps to keep the focus on the main goals during the development of the lesson. When you are done you can go back and see if there are other outcomes that are addressed as you'll often find that even a single lesson addresses multiple outcomes or objectives. This part should also be filled out at the beginning along with the rationale.

Instructional Objective(s)

What are the specific things students will be able to do as a result of this lesson? Remember that objectives are the things the students will know, feel, and be able to do after successfully completing this lesson. These objectives should be consistent with the stated learning outcome(s) such ensuring students are be able to explain why their Angry Bird did or did not hit its intended target. The objectives may also include things the teacher wants to observe in the course of the lesson such as being able to identify the potential leaders in group discussion. Make sure that the instructional objectives are measured by your assessment and evaluation strategies.

Instructional Strategies

How will you approach this lesson? Is there is a single strategy you plan to use for the entire lesson, or will you use several for different parts? The instructional strategy should help your students to meet the instructional objectives.

Prerequisite Concepts and Skills

What will you assume your students already know? What skills and concepts must they have and understand and to what extent? This section helps connect this lesson to others in a logical way. It also helps build new knowledge onto what your students have previously learned. If necessary, include those skills and understandings that may need to be reviewed.

Game

Provide a brief description of the game and its objectives. Identify how the game connects with the learning outcomes and the instructional objectives. List the resources necessary to use the game. What capabilities do the computers need? Does the game need to be installed? Is there any special software it requires? If the students will need anything in addition to what the teacher needs, include that to make sure the game is available on their devices, work through the game's tutorial, etc. The resources for the game are listed separately from other resources for the lesson. This should include such things as the 4PEG review of the game and any community websites, instructional manuals, teacher guides, or other documents related to the game.

Other Materials and Resources

List all topic and content related materials and resources that you and the students will need in this section. Are there things you need to do before the lesson begins including preparing a word chart, post links to resources on the class website, etc.? What do the students need to do?

Lesson Activities and Teacher Roles

This is where you outline the things that you and your students will do before playing the game (pre-game), during the game (in-game), and after (debriefing, or post-game). This is where the list of ways to use games and the instructional strategies come into play. You can choose from the lists provided earlier in this chapter. The ways to use games list is quite comprehensive, but you can also find hundreds of additional instructional strategies that can be looked up online (the website for the book has a section with links to a wide variety of instructional strategies). Remember also to note the teacher roles (Table 8.1) that you think are appropriate for each of the three sections.

Pre-game:

- How will you get students interested in the topic? Do not assume that they will automatically be interested, simply because they are using a game.

- How will you find out what they already know about the topic? Will you use something like advance organizers?
- Do they need time to learn how to play the game before beginning the activity?
- What will you do with students who already know how to play the game?
- What about students who have never played videogames?
- How will you prepare them to attend to the objectives during play?

In-game:

- What sequence of activities will the student experience?
- What will you do?
- What will they do?
- What will children do who finish early?
- How much time will each activity take?
- What about clean up?
- Will you guide them through their play session or are they playing on their own?

Debriefing:

- How will you end the play session?
- Where will they "re-convene" for the debriefing?
- How will you end the lesson?
- The closing should be linked to your instructional objectives.
- The debriefing should help students reflect on or summarize what they have learned.

Universal Design for Learning (UDL) and Differentiated Instruction (DI)

We know that people learn in different ways and have different needs. This section of the lesson plan asks: How will you accommodate your diverse learners? What are the individual needs within this classroom and how will you accommodate them? What are the adaptations and modifications needed for students with Individual *Education Plans (IEPs)*? *Universal Design for Learning* (Rose, Meyer, & Hitchcock, 2005) is a framework for designing curricula that takes special needs into consideration.

UDL includes:

- Multiple means of representation;
- Multiple means of expression; and,
- Multiple means of engagement.

This section should also include any notes about how the lesson addresses general diversity issues (gender, culture, race, language, religion). The idea behind *Differentiated Instruction* (Tomlinson, 2014) is that students will learn differently at different times and that individuals will have different needs at different times as well. Combining both UDL and ID allows us to acknowledge those differing needs and build accommodations into our lessons that help to make it accessible for all of our students. DI can be built into the lesson in four ways: content, process, product, and, learning environment based on the individual learner.

Organizational Strategies

This is an aspect rarely addressed in most instructional design models but anyone who has spent time in the classroom knows that carefully thought-out organizational management strategies can mean the difference between completing your lesson and not doing so. Not all of these will apply at any given time, but the kinds of questions to be considered here include how to:

- Bring the class together at the start of the day/lesson.
- Utilize student helpers to facilitate the flow of lessons and the day in general.
- Distribute and collect materials.
- Separate the class into groups or levels (In what situations should groups be assigned ahead of time?).
- Coordinate different grade levels working on different assignments.

Behavior Management Strategies

This tends to be more of an issue with younger learners, but it is something to consider in any lesson. Having a plan for handling various behavioral concerns in advance can also help a class to run smoothly for all. What strategies will be used?

Assessment and Evaluation

Although this section appears near the end of the lesson plan it does not mean that assessment must necessarily occur at the end of the lesson. There are a variety of metrics that can be used during the lesson as well. Often there will be scores or other metrics in the game itself that you can make use of.

- What, if any in-game metrics will be used? Succeeding at the game is a form of assessment and playing is learning, but we still need ways to measure that learning that will be recognized.
- Did the students learn what you taught them?
- The results of the assessment should be directly related to your instructional objectives and prescribed learning outcomes.
- Your assessments should be a record of whether and how well your learners met the outcomes and objectives.
- Your assessment should be as accurate as possible and should be built into your lesson.
- What rubrics or structures will you use to evaluate assessment data? Is assessment formative or summative? Include the assessment tool.

Extensions

This section can help you grow your lessons to address other outcomes and even other topics. This can be started when you first create the lesson plan but should be revisited as often as possible.

- How might this lesson link to previous and/or future lessons within the same curriculum area?
- How might knowledge, skills or attitudes from this lesson be integrated / infused into lessons in other subject areas?

Reflections

A lesson plan should be a living document, meaning it should change and evolve as you gain more experience with its implementations in the classroom. You should try and complete the reflections section as soon as possible after teaching the lesson.

- What went well?
- If you had it to do over again, what would you change?
- Are there parts you would leave out? New ones to add in?
- What, if any strategies would you change?
- How did the teacher roles work out?
- Be sure to note any resources (including people and places) that were especially useful and any you needed but didn't have.

10.4 Template: Single Lesson

The following sections will develop three different lesson plans. Each starts with a context (grade and subject) and uses one of the games that was analyzed in the previous chapter. The reality is that almost no-one ever starts from scratch when creating lesson plans (or curricula for that matter). If you're a teacher, you will usually know who your audience is and what you are trying to teach—at least in general terms. If that is where you are starting, then choosing the right game is easier if you already know about a lot of different games, or if you have access to someplace where games are sorted according to subject and grade. Alternately, you may end up in the situation where you become aware of a specific game and you are either told that it is good for such and such by someone you trust, or you realize on your own that this game would be good for teaching a particular topic, concept, process, or skill. In both cases we will usually start developing our lesson plan already knowing what we want to teach and which game we want to use.

What then should the next step be? We know what we need to teach, who we need to teach, and we have a game we think will help us. Before we spend any more time trying to create a lesson, we should ensure that the game we want to use really does have the potential to help our students meet some mandated curricular objectives. We've said this before, but it bears repeating: for that we need to know the game (just like with any other medium we want to use in the class, whether it is a novel, play, film, TV show or anything else). At the time of this writing, most current review sites still don't really give us enough detail to answer this question (unless of course they have specifically mentioned the prescribed outcomes), so this is where we begin with our lesson planning. The first thing we need to do (if we don't already know this) is locate the formally mandated curricular objectives for the subject we want to use the game for. We need to find a match for what we believe the game can help us teach and what we need to teach. We may already have a pretty good idea of how we want to use the game, but the lesson plan helps us operationalize what we intend to do and how it will help our students. The rationale, overview, outcomes and objectives may all be filled out at pretty much the same time. Try to remember that the things you fill out are only "drafts"—you should be willing to adjust them as necessary. Also, don't attempt to "cover" too much at once. As has been said before, it is better to have a game do one thing really well, than may things poorly (Heeter, 2013). However—being able to meet some specific mandated objectives remains important if we are going to be able to justify the continued use of games in the classroom.

The next steps I would recommend are to review the lists of "ways to use games" and "instructional strategies." These will help you zero in on how you are going to use the game and begin to connect what you want to do with the affordances of the game. You should also make notes of any prerequisite concepts and skills the students will need. Each of the three lesson plans we will develop is briefly outlined here and the completed lesson plan is shown in the following sections.

10.4.1 Example 1: Real Lives, Social Studies, Grade 3

Our first lesson plan will be for a lesson meant to span several classes with gameplay in the middle using Real Lives as a sources of content to explore various communities around the world. This is a grade 3 class and the kinds of strategies we adopt need to be appropriate for 8–9 year olds. The following is a list of 8 possible strategies that we could choose:

- 11. Autobiographies: Write the life of your character as an autobiography, or write an "annual letter" using a particular year in your character's life, or write a diary entry for 1 day in his/her life.
- 13. Biopoem: Written about your character. Follow the guidelines as outlined in instructional strategies section.
- 52. Justifying: Have students explain their rationales for the decisions they make in the game. In a grade three class it may be helpful to provide concrete guidance for this strategy such as providing them with a set of predefined justification "coupons" (e.g., Just Because, Random, Best Choice, and Worst Choice) that they can use while playing the game. When they use a coupon, they need to record the nature of the choice and their reasons for using the coupon.
- 85. Shared Gaming: This would extend the lesson over multiple classes. Play the game together as a class. Discuss the character as you go along, and allow the class to help make decisions when they come up.
- 74. Relay Summary: Have the class retell the story that they have all played together (requires shared gaming).
- 75. Retelling the Story: Have the student write the story of the person whose life they just played.
- 76. Rewrite the Ending: Let students rewrite the ending of their own character and look at why this might or might not be realistic given the character's demographics.

- 88. Story Maps: Have students create a story map or family tree of the character's life.

The lesson we develop uses the strategy of a biopoem. This will provide sufficient structure to encourage a fairly complete retelling of the life, while also encouraging creativity.

10.4.2 Example 2: Science, Osmosis, Grade 7

Our second lesson uses the game Osy Osmosis as an environment to explore the process of osmosis and diffusion in a single class with possible follow-up in a subsequent class. This is not going to be the only lesson on osmosis and diffusion—it is intended to supplement and help to consolidate what is learned in other lessons. It is also meant to break up the "hard" science lessons and labs with something a little lighter. There are at least eight different learning strategies that could be used for this lesson:

- 8. Anticipation Guide: Before playing through a level or game, students respond to several statements that challenge or support their preconceived ideas about key concepts in the game.
- 16. Checklist: Create a checklist and have students check off the things they saw/experienced.
- 24. Critical Incident Questionnaire: to help students reflect on their actions in the game.
- 32. Expectation Outline: A variation could be that the teacher starts the outline with one or two concepts, terms, etc.
- 33. Experiment: develop an experiment that can be quickly tested in the game. This would be done after the students have had a chance to play for a while. What's important here is the hypothesis they are trying to test and how they plan to test it rather than ending up with a successful conclusion.
- 35. Field Guide: create a field guide for all the "characters" (objects) in the game: their properties, what they like, what they don't like, and why.
- 44. Game Logs: To record the student's progress, challenges, and triumphs. These can later be related to the osmosis process model.
- 59. Muddiest Point: Have students write down their muddiest point to discuss in class.

The lesson we have developed uses strategy #35: Create a Field Guide. This one allows us to be lighthearted and have a bit of fun, while still focusing on the actual science involved.

10.4.3 Example 3: September 12, Social Studies, Grade 12

Example three will uses the news game September 12 as a lesson opener for a single class.

Although this is potentially a difficult subject because of how emotionally charge it could be, there are quite a lot of possibilities for using this game as a lesson opener:

- 26. CROWN (?) C=Communicate what you learned. R=Reaction. O=Offer one sentence that sums up what the whole lesson was about. W=Where are some different places you could use what you have learned? N=Note how well we did today.
- 39. Find the Rule: This strategy can help deconstruct the game. Can the students identify the "rules" that are used for how collateral damage is determined? How many terrorists are "generated" with each missile? How long before you can shoot again? How long before terrorists turn back into civilians? How long before buildings are rebuilt? How big is the map?
- 45. Game Pitch. How would you sell this game to a potential funder? Aid agency?
- 65. Position Paper: Choose a position based on the game and defend it. It doesn't need to be a position you believe, merely a plausible one.
- 70. Question the Developer: What questions would you ask the developer? What answers do you imagine they'd give?
- 78. Role/Audience/Format/Topic (RAFT)
- 93. Through the Eyes of the Enemy: Imagine yourself as one of the terrorists. What is your backstory? How do you react to what's happening in your village?
- 94. Value Line: Write a statement regarding an approach to dealing with terrorism and allow students to choose a position along the value line. Discuss their rationales for their choices.

As this is a more senior class and deals with a mature subject, we are going to give the students a choice of ways to approach the lesson. Given the potentially sensitive nature of the material however, it will only be graded for participation and not content. The lesson plan is developed using 39. Find the Rule; 45. Game Pitch; 70. Question the Developer; and 93. Through the Eyes of the Enemy.

10.4.4 Example 1: Grade 3 Social Studies with Real Lives

This one is an example of a lesson meant to span several classes with gameplay in the middle. We will be using Real Lives to explore various communities around the world. After the initial introduction to the game, students will either play on their own or in small groups and then share their results with the rest of the class. Given that this is a grade three class, it should be noted that it might require additional volunteers to help students get through the game and keep on track, but the realism of the characters they play and the fact that they can each play someone unique gives this lesson potential connections that reading a story or watching a video about one or two individuals cannot.

Lesson title	Total lesson time	Lesson # of #	Date
Experiencing Real Lives Around the World	100 min (2 classes)	1 of 1	June 2015

Author	Subject	Grade(s)	Game	Used as
K. Becker	Social Studies and Geography, Cross-Cultural Understanding	3	Real Lives	Content

Rationale and Overview:

To gain an appreciation for how live in other parts of the world and how the place you are born can affect your life.

Prescribed Learning Outcome(s):

**Note: These are outcomes as outlined in* (Alberta Education, 2005b, p. G3.3–4).

- [3.1.1] Appreciate similarities and differences among people and communities:
- Demonstrate an awareness of and interest in the beliefs, traditions and customs of groups and communities other than their own
- [3.1.2] Examine the social, cultural and linguistic characteristics that affect quality of life in communities in other parts of the world by exploring and reflecting upon the following questions for inquiry.

Secondary Outcomes:

- What determines quality of life?
- How does access to public services affect the communities? (e.g., schools, hospitals, libraries, transportation systems)?

Instructional Objective(s): The student will be able to (TSWBAT)…

- Students will identify three similarities and three differences between the daily life of the person they played in the game and the daily life of a child at home.
- Compare and contrast one's own culture with those of other children around the world.
- Locate the countries and cities of the people they played in the game.

Instructional Strategies:

[13] Biopoems

Prerequisite Concepts and Skills:

- Familiarity with prose.

Other Materials and Resources:

Teacher	Students
3. Social Studies Grade 3—communities in the world p. G3.3–4 https://education.alberta.ca/media/456082/sockto3.pdf (Alberta Education, 2005b) Biopoems: http://www.readwritethink.org/files/resources/lesson_images/lesson398/biopoem.pdf	Complete a biopoem by filling in the following lines: (Line 1) First name (Line 2) Three or four adjectives that describe the person (Line 3) Important relationship (daughter of …, mother of …, etc.) (Line 4) Two or three things, people, or ideas that the person loved (Line 5) Three feelings the person experienced (Line 6) Three fears the person experienced (Line 7) Accomplishments (who composed …, who discovered …, etc.) (Line 8) Two or three things the person wanted to see happen or wanted to experience (Line 9) His or her residence (Line 10) Last name

Game:

Description	Curricular ties
Real Lives is an educational simulation where the player takes on the role of a person chosen for them at random, using global statistics. The game starts off on the day they are born and every turn represents a year. As the time goes the child grows up and you are told about their family—all events are created using real data.	This connects with any part of the curriculum that relates to learning about and understanding how people in other parts of the world live.

Game Requirements (computers and other equipment)

Teacher	Students
Nothing beyond what the students have.	The game runs on PCs. It has no heavy graphics or animation and so can easily run on older machines. Students can play in pairs if there aren't enough machines to go around.

Game Resources (websites, communities, teacher and student guides, etc.)

Teacher	Students
http://www.educationalsimulations.com/ Real Lives Teacher Guide	

Lesson Activities:

Teacher activities and roles	Student activities	Time
Pre-game (1st class): Introduce the lesson. Ask students what they do in their spare time.	Discussion and sharing	10 min
Explain biopoem. Hand out a sheet with the lines of the biopoem listed and a space for students to write the details as they come across them.		5 min
Explain the game.		10 min
Do brief run-through of the game.		15 min
Create a sample biopoem about the life they played.		10 min
Game (2nd class): Get everyone set up. Check the characters they have been assigned by the game (you may wish to make some adjustments)		5 min
Play the game. Assist students to fill in the bio-details they will need.	Make notes about their person on the handout sheets.	45 min
Debriefing:	Complete a biopoem.	15 min
	Ask some of the pupils/students to share their writing with the rest of the class.	10 min

Universal Design for Learning (UDL) and Differentiated Instruction (DI):

- Be prepared to help students notice key events, and write down the things they will need for the biopoem.

Organizational Strategies:
All students will have a biopoem form so they will know what to record.
Behavioral Management Strategies:

- Be sure that students understand why they are playing this game.
- Be prepared to pair up students if they are struggling too much with the game.

Assessment and Evaluation:

- Pre-game: None.
- In-game: Informally—make sure students are writing down the biographical details they will need.
- Post-game: Check the biopoems to ensure they have followed instructions correctly and that they have included the necessary details.

Extensions:

Continue on with several more rounds playing Real Lives, use some other strategies to reflect on and summarize the lives they saw.

Possible strategies: Story maps; Rewriting the ending; Autobiographies.
Reflections:
None yet.

10.4.5 Example 2: Grade 7 Science with Osy Osmosis

Using the game Osy Osmosis to explore the process of osmosis and diffusion in a single class with possible follow-up in a subsequent class.

Lesson title	Total lesson time	Lesson # of #	Date
Experiencing Osmosis	50 min (1 class)	2 of 5	June 2015

Author	Subject	Grade(s)	Game	Used as
K. Becker	Science Unit B: Plants for Food and Fiber (Science and Technology Emphasis)	7	Osy Osmosis	Process

Rationale and Overview:

Osmosis is a process in which water moves through a membrane. Water normally moves from the side of the membrane with a high concentration of water to the side with a low concentration of water. When referring to the movement of water, it is called osmosis, but when referring to the movement of other substances, it's called diffusion.

This lesson is meant to help students gain an intuitive understanding of osmosis by playing with Osy, who is a character in the game who grows and shrinks according to the typical "laws" of osmosis.

Prescribed Learning Outcome(s):

**Note: These are outcomes as outlined in* (Alberta Education, 2003b, p. 15).

- Investigate life processes and structures of plants, and interpret related characteristics and needs of plants in a local environment.

Secondary Outcomes:

- Describe the processes of diffusion, osmosis, and conduction of fluids in plants.

Instructional Objective(s): The student will be able to (TSWBAT)…

- Describe the actions and interactions in the game using the appropriate terminology.
- Explain osmosis and diffusion using Osy and what happens to her as an example.

Instructional Strategies:

- This is a single class with a possible follow-up in a subsequent class, but it is part of a larger unit on osmosis and diffusion.

- 35. Field Guide: create a field guide for all the "characters" (objects) in the game: their properties, what they like, what they don't like, and why.

Prerequisite Concepts and Skills:

Students should have a basic understanding of cell structure and biological molecules. They should also be familiar with the concepts of solutes, solvents, and concentration.

This item requires a general understanding of the processes; it does not require knowledge of the specific biochemistry of these processes.

Other Materials and Resources:

Teacher	Students
Science Grade 7—Osmosis p. 15 https://education.alberta.ca/media/13335879/pos_science_7_9.pdf (Alberta Education, 2003b)	Field Guide forms (1/2 sheets, one per object)

Game:

Description	Curricular ties
http://www.osyosmosis.com/ Osy Osmosis is a game about Osy, a little cell-like creature who has a semipermeable "skin." The goal of the game is to capture stars, but Osy lives in a solution with a variety of different concentrations, and where the concentrations of solutes changes. We can add and remove solutes as needed in order to maintain homeostasis as Osy wanders around finding her stars.	Although there is little educational support in this game, the process is relatively accurate, so it provides us with a test environment where we can explore the processes of osmosis and diffusion.

Game Requirements (computers and other equipment)

Teacher	Students
The game works on PCs as well as mobile devices. We will use one of the computer lab rooms.	Be prepared to take notes as you are gaming.

Game Resources (websites, communities, teacher and student guides, etc.)

Teacher	Students
No other teacher resources at this time	Osy Learning Guide (http://www.osyosmosis.com/wp-content/uploads/2014/05/Osy-learning-guide.pdf) Diffusion & Osmosis, Biology Corner.com http://www.biologycorner.com/bio1/notes_diffusion.html Wikipedia entries on Osmosis & Diffusion YouTube video on Osmosis: https://www.youtube.com/watch?v=w3_8FSrqc-I

Lesson Activities:

Teacher activities and roles	Student activities	Time
Pre-game: role: instructor	Watch the YouTube Video Osmosis: A Solute and Solvent Love Story https://www.youtube.com/watch?v=IaZ8MtF3C6M	10 min
Hand out the field guide forms while explaining the activity	Form groups of 3.	5 min
Game: Roles: guide; observer; playmaker; SME	Play the game in groups. Take turns playing and writing notes for the field guide.	20 min
Debriefing: Roles: SME; guide	Finish up the field guides, and submit them.	15 min

Universal Design for Learning (UDL) and Differentiated Instruction (DI):

Create a sample field guide entry to show. Teacher should be prepared to help students fill in one or two sheets if they are having trouble getting the hang of it.

Organizational Strategies:

Make sure there is room for three to sit at every computer.

Behavioral Management Strategies:

Make sure everyone understands they will all have a chance to play the game (use a timer or hourglass). Have them draw numbers or colored cards—each group member gets a different color. All students with the same color play at the same time.

Assessment and Evaluation:

Marked out of 10. 10 % of science unit B term work.

- Pre-game: None.
- In-game: None.
- Post-game: Have students submit their field guides. Grade with Field Guide Rubric.

Extensions:

Could have them do screenshots to include in the field guides.

Reflections:

None yet.

10.4.6 Example 3: Grade 12 Social Studies with September 12

Our third example uses the news game *September 12* as a lesson opener for a single class. This is a short from game that only takes a few minutes to play. The game has no ending so the game session will be terminated by the teacher. This game will likely have its greatest potential impact if it is not discussed first, so the idea is to have the students come into the class and sit down at computers where the game has already been brought up on the screen. If it is a class where students have laptops, they can be instructed to go to the given URL without explanation. Once they've had a few minutes to explore the game, then the real lesson can start. Given that this is has the potential to be a highly charged topic, this lesson will only include assessment for participation. There should be no right or wrong approaches here. The overall goal is to recognize that this is a complex issue and as a result it can not have any simple solutions. The game and activities are meant to provoke thought.

Lesson title	Total lesson time	Lesson # of #	Date
What is Terrorism?	50 min (1 class)	1 of 1	June, 2015

Author	Subject	Grade(s)	Game	Used as
K. Becker	Social Studies	12	September 12	Lesson Opener

Rationale and Overview:

To explore a variety of perspectives on approaches to terrorist threats, including, but not limited to: military, humanitarian, and nonviolent responses. It is important to recognize that this is a very complex issue with no simple solution, and that there are advantages and disadvantages to each.

Prescribed Learning Outcome(s):

**Note: These are outcomes as outlined in* (Alberta Education, 2005a, p. 23).

- Key Issue: To what extent should we embrace an ideology?
- Evaluate the extent to which the principles of liberalism are viable in the context of contemporary issues (environment concerns, resource use and development, debt and poverty, racism, pandemics, terrorism, censorship, illiberalism)

Secondary Outcomes:

- Students will assess the extent to which the principles of liberalism are viable in a contemporary world.
- Analyze the extent to which liberal democracies reflect illiberal thought and practice (… contemporary examples)

Instructional Objective(s): The student will be able to (TSWBAT)…

- Articulate some of the issues surrounding various response approaches to the threat of terrorism.
- Recognize that there may by more than one side to this issue.

Instructional Strategies:

39. Find the Rule
45. Game Pitch
70. Question the Developer
93. Through the Eyes of the Enemy.

Prerequisite Concepts and Skills:
Basic awareness of world events in this century.
Other Materials and Resources:

Teacher	Students
Social Studies 30—ideology / liberalism p. 23 https://education.alberta.ca/media/774377/soc30.pdf (Alberta Education, 2005a)	• Constitutional Rights Foundation: http://www.crf-usa.org/ • The Terrorism Research Center, "The Basics of Terrorism: Part 1″ • Ayatulla Shaykh Muhammad 'Ali Taskhiri, "Towards a Definition of Terrorism" • United Nations Office for Drug Control and Crime Prevention, "Definitions of Terrorism"

Game:

Description	Curricular Ties
http://www.newsgaming.com/games/index12.htm	Connects up with world history and current events.

Game Requirements (computers and other equipment)

Teacher	Students
	Requires Internet access, and flash.

Game Resources (websites, communities, teacher and student guides, etc.)

Teacher	Students
–	–

Lesson Activities:

Teacher activities and roles	Student activities	Time
Pre-game: The game needs to be set up to the start page on all the computers in the room so that when the students come in they can sit down and play with the game. *NOTE: Be sure to give students advance warning that the subject matter of this lesson may be controversial and disturbing for some (trigger warnings).*	None.	5 min

Teacher activities and roles	Student activities	Time
Game: Supervise students while they explore the game. Teacher roles: Playmaker, Guide, Referee	Play the game however they choose.	5 min
Debriefing: Questions to prompt discussion: What do you think the game was about? What did you think when you saw what happened after you fired your missile?	Discussion.	10 min
Tell them they may choose from four different approaches, and explain each: 39. Find the Rule (2–3 rules) 45. Game Pitch (1 min or 1 page "ad") 70. Question the Developer (2 Q&A) 93. Through the Eyes of the Enemy (1 paragraph)	Individually or in small groups, have each choose an approach and prepare a 1 min or 1 page response.	20 min
	Those who wish to share can do so.	10 min

Universal Design for Learning (UDL) and Differentiated Instruction (DI):
Make note of trigger warning.

Allow students to opt out, especially if they have personal connections (i.e., military, refugee, etc.) Students who have opted out will be allowed to do an alternate reading.

Organizational Strategies:

The game will be set up in the lab when the students come in. They will be allowed to play for a few minutes and then the majority of the rest of the class will be post-game. We could leave a few minutes at the end of the class for people to have a second look at the game.

Behavioral Management Strategies:

Be aware of emotional reactions.

Assessment and Evaluation:

- Pre-game: N/A.
- In-game: None.
- Post-game: Marked on participation only.

Extensions:

Include some of the other strategies.

Reflections:

None yet.

10.5 Template: Unit

A *unit plan* is a way of organizing the lessons contained within the unit to help ensure that the unit is complete. When designing a unit plan we tend to look at it from a higher level of abstraction. The unit plan is an overview of a collection of related lesson plans, and the main goal of the unit plan is to create continuity and coherence between the individual lessons of a unit. In our case we are focusing on a unit plan that includes one game that will be used for much or all of the unit. This unit plan will help to ensure that our lessons are well balanced and include a variety of approaches.

The template included in Chap. 12 has a number of sections. This plan is a generic one that can be adapted to specific subject areas as necessary. It this one is adapted from the Unit Plan Template document created by the faculty at the Thompson Rivers University Bachelor of Education program (TRU Education Faculty, 2015b). One goal in developing a unit plan is to develop it in enough detail that another teacher could use it, with sufficient information in each category that applies. The explanations for the sections are below.

Rationale: Why are you teaching this unit? If there is a mandated curriculum that this unit addresses, it can be summarized here. We should also provide a statement explaining why the game we have chosen is appropriate in this context.

Unit Overview: This should be a fairly short description that Includes what the unit is about and how it fits into the larger context. What are the main concepts, skills and/or understandings that students should get out of this unit?

Game Overview: Provide a brief description of the game to be used and how it will be used during the lessons in the unit. Will it be used for everything, or just occasionally? You might want to refer to the list of 15 Ways to Use Games to outline how the game will be used in this unit.

Prescribed Learning Outcomes (**PLO**): This is where we can state the official learning outcomes. It is a good idea to reference the source here, as these can change from time to time. Knowing which version this unit was designed to address can be useful if something changes. We can more easily find out what, if anything needs to be adjusted here.

Prerequisite Concepts and Skills: Is there something specific (concepts, skills, facts, etc.) that students need to know coming into this unit? What does it build on? What prior knowledge does it assume? Is it assumed that students will already know how to play the game (perhaps from a prior unit) or are we starting from scratch?

Teacher Preparation Required: Is there something you need to do before the unit begins? Are there any supplies or other materials you need? Do they need to be ordered in advance? Do you need to inform anyone else (such as the librarian) so they can have things ready that you will need? Does the game need to be purchased / updated/installed somewhere? Are there licensing concerns to be dealt with? If there are links to communities, web pages, or other resources, these should be checked to make sure they still exist. If you have downloaded or printed copies of documents or other items, it might be a good idea to check them to make sure they are still available and to see if they have been changed.

Cross-Curricular Connections: Does this unit connect with other units or subjects? If there are any specific outcomes from other areas that are addressed in this unit, include them here.

Extensions to Unit: Include any activities or strategies that you might want to add to the unit, either to add to what there is now or for enrichment.

Resources: This serves as a sort or master-list of resources that can be used with this unit. Include the technology requirements, and where items can be obtained.

Overview of Lessons: This section serves as a summary of the lessons in the unit. List each one along with its title, sequence number, length, whether or not this lesson uses the game (or a different game), and the learning outcomes. To keep things concise, it may be useful to list the learning outcomes at the top and assign some sort of code to them that can then be noted in the list. It might also be helpful to create a cross-reference in the list of objectives. That way you will be able to see easily which objectives are being met and whether or not any have been missed. This will also help you see if you are favoring any particular objectives. If so, you can then create lessons to round things out. You may also want to add other details so that you can see the unit as a whole. If you note the instructional strategies, for example, you may notice that you tend to use a few far more often than others. Even if you are using a game that everyone is excited about, it is important to vary your approaches.

Universal Design for Learning (UDL) and Differentiated Instruction (DI)

When doing unit plans this section is meant to serve as a more general overview than is seen in the lesson plans of the kinds of approaches planned to accommodate diverse and individual needs.

Reflections and Revisions: This section is for future reference and allows you to keep a log of what went right, what needs to change, things you forgot, and anything you'd like to add.

We will use a Grade 12 English Language Arts unit on literature as our example.

10.5.1 Grade 12 English Language Arts Unit with Gone Home

For the example unit plan, we take one that was taught in a high school English class in 2014. For as long as most of us can remember, we have studied works of fiction to gain insights into the human condition as well as to look at creative expression and how situations and characters can be brought to life in stories. There are some games that include deep and compelling narratives, and *Gone Home* is one of those. It is relatively unique in that there is no dialog in the game, nor are there any people, just an empty house rife with artifacts that act as clues to tell the story of the people who live in the house. Players are able to wander about the house and look at almost everything, in almost any order, and this provides an opportunity to examine narrative in a way not possible in a linear text.

As always, instruction must be connected to the prescribed outcomes for the class we are teaching. Sometimes the list of outcomes is fairly concrete and relatively easy to match to your lessons, and sometime it is more subjective, such as this one. The following is a summary of the outcomes as defined in a grade 12 English Language Arts program (Alberta Education, 2003a). The outcomes have been numbered so that they can easily be matched in the unit plan without having to repeat them.

Listen, speak, read, write, view, and represent to:

1. Explore thoughts, ideas, feelings, and experiences:
   1.1. Form Tentative Understandings, Interpretations, and Positions
   1.2. Experiment with Language, Image, and Structure
   1.3. Consider New Perspectives
   1.4. Express Preferences and Expand Interests
2. Comprehend literature and other texts in oral, print, visual, and multimedia forms, and respond personally, critically, and creatively:
   2.1. Discern and Analyze Content
   2.2. Understand and Interpret Content
   2.3. Relate Form, Structure, and Medium to Purpose, Audience, and Content
3. Created Effects:
   3.1. Evaluate the Verisimilitude, Appropriateness, and Significance of Print and Nonprint Texts
   3.2. Appreciate the Effectiveness and Artistry of Print and Nonprint Texts
4. Manage ideas and information:
   4.1. Plan Inquiry or Research, and Identify Information Needs and Sources
   4.2. Evaluate Sources, and Assess Information
5. Create oral, print, visual, and multimedia texts, and enhance clarity and artistry of communication:
   5.1. Assess Text Creation Context
   5.2. Consider and Address Form, Structure, and Medium
   5.3. Develop Content
   5.4. Use Production, Publication, and Presentation Strategies and Technologies Consistent with Content
6. Respect, support, and collaborate with others:
   6.1. Use Language and Image to Show Respect and Consideration
   6.2. Appreciate Diversity of Expression, Opinion, and Perspective

This unit plan has been reproduced with permission from the notes kept by Paul Darvasi who used *Gone Home* as a literary text in his senior high school English classes. As the use of a game such as this for literary study is still very uncommon, Darvasi devised his own instructional strategies. Some can be mapped onto ones listed in the previous chapter, but others are new.

10.5.2 Unit Plan Template

Adapted with permission from: Unit Plan Template EDPR 3200 4100 4200 @ http://www.tru.ca/hse/education/bed/practica/plans.html.

Unit title: Grade 12 English Language Arts Unit with Gone Home	
Number of lessons: 8	*Time*: (in weeks) 4
Teacher name: Paul Darvasi	*Subject*(*s*): English *Grade*(*s*): 12
Game used: Gone Home	*Used as*: Literature

Rationale: Using a game as an alternative to a novel can open up possibilities for the examination of a nonlinear narrative and how character can be developed through setting.

Unit Overview: Students will play through the game completing various assignments along the way.

Game Overview: Gone Home is a story adventure that takes place in a home of the Greenbriar Family in 1995. Kaitlin arrives at her parents' house to find no-one home and a note from her sister on the front door. Kaitlin must uncover the clues in the house to find out what happened.

Prescribed Learning Outcomes from IRPs: See List in previous section. 1.3, 2*, 3.1, 4.1, 5*, 6.1, 6.2

Prerequisite Concepts and Skills: It was assumed that students had some game playing experience. They have also done previous novel studies so the basic idea of approaching a literary work for study was familiar to them.

Teacher Preparation Required: Play the game all the way through. Look at a variety of reviews of the game. Acquire copies of the game for all students and make sure it is installed on their laptops.

Cross-Curricular Connections: N/A

Extensions to Unit: Not yet.

Universal Design for Learning (UDL) and Differentiated Instruction (DI): Students are given a variety of ways to approach the game text, including choices of themes to track while playing.

Resources: http://www.gonehomegame.com/, http://www.wordle.net/, http://www.ludiclearning.org

10.5.2.1 Overview of Lessons

Lesson 1 Writes of Passage, Annotating a Foyer and Screenshot Citations

PLOs in lesson: 1.3, 2.1, 2.3

Instructional Objectives: Orientation to game interface and overview of major characters.

Teaching Strategies: General introduction to the game and game studio that developed it. Introduction to the basic gameplay elements

A chart will be provided with guiding questions that will be answered based on documents and artifacts in the house's foyer. Students will spend the class exploring the foyer, taking screenshots and filling in the chart.

Lesson Activities: Students will take screenshots in the game's foyer and complete a chart which will familiarize them with gameplay, the main characters, taking screenshots and in-game movement.

Assessment Strategies: N/A

Materials (Specific to This Lesson): Laptops; Copy of *Gone Home;* Foyer Annotation Chart

Game Details: Main Foyer of the Greenbriar home

Lesson 2 Ordering the Free-Roving Chaos

PLOs in lesson: 1.3, 1.4, 2.*, 3.1, 4.1

Instructional Objectives: Students will practice note taking and close reading exercises as the explore the house and uncover the narrative.

Teaching Strategies: Students will choose one of the 6 topics provided and track it as the openly explore the house. Once the topics are discussed and chosen, students will explore the house gathering screenshots and taking notes.

Lesson Activities: Play game and complete notes for tracking.

Assessment Strategies: Charts from previous class taken up.

Materials (Specific to This Lesson): Laptops; Copy of *Gone Home;* Topic Tracking Logs.

Lesson 3 Sound Bites, Word Clouds, and Vision Quests

PLOs in lesson: 5.*

Instructional Objectives: Students will learn to distinguish between mood and tone in settings.

Teaching Strategies: Students will read a document that explains the difference in mood and tone when describing setting. They will create collaborative Wordle word cloud using words that describe the mood and tone in *Gone Home*.

Lesson Activities: Read about mood and tone and create relevant word clouds.

Assessment Strategies: Students will review their final clouds as a group and critique them for accuracy.

Materials (Specific to This Lesson): Laptops; Copy of *Gone Home;* Mood and tone handout; Wordle

Lesson 4 Bursting the Fantasy Classroom Bubble with Real World Reviews

PLOs in lesson: 5.3, 5.4

Instructional Objectives: Students will think critically about their gameplay experience by writing game reviews.

Teaching Strategies: Students will read a variety of professional game reviews prior to writing their own based on their experience playing *Gone Home*. A general outline of how to structure the review as well as a rubric will be provided.

Lesson Activities: Read and write game reviews based on their experience with *Gone Home*.

Assessment Strategies: The reviews will be collected and graded according to a rubric provided in advance.

Materials (Specific to This Lesson): Sample game reviews; Review outlines; Review rubrics

Lesson 5 and 6: Spoiler Alerts, Disposable Stories, and Non-perishable Narratives

PLOs in lesson: 5.2, 5.3, 5.4, 6.1, 6.2

Instructional Objectives: Students will synthesize their notes and work in groups to design presentations on their assigned topics.

Teaching Strategies: Students will use to classes to meet and develop their presentations. The teacher will review best presentation practices and work with each group, providing feedback during development.

Lesson Activities: Working on reviews and Group Presentations

Assessment Strategies: N/A

Materials (Specific to This Lesson): Laptops; Keynote.

Lesson 7 and 8 Crafting an Epic Slideshow for a Purple Basketball Revelation

PLOs in lesson: 5.2, 5.3, 5.4, 6.1, 6.2

Instructional Objectives: Students exercise presentations and public speaking skills.

Teaching Strategies: After each presentation, the teacher will provide informal feedback as well as a graded rubric for each individual's contribution to the presentation.

Lesson Activities: Presentations and peer/teacher feedback.

Assessment Strategies: Presentations will be graded according to a rubric provided in advance.

Materials (Specific to This Lesson): Data projector; Laptops; Keynote.

Reflections/Revisions (if necessary, continue on separate sheet)

None yet.

10.6 Using Games as a Long-Term Resource

When designing a curriculum for a long period of time like a semester or year, there is a different focus. Rather than games that might be used for one or two lessons, seek those that might use for more than one unit and possibly even more than one subject. In this case there either needs to be a close match between the content of the game and the subject and topics taught. The game should provide the kind of environment that will allow us to make use of it in a variety of ways. To make repeated or sustained use of this game, then we can also afford to use one that takes longer to learn how to play.

Games that are suitable for this sort of approach are those like *Civilization*. Other suitable types are more open games that have many possibilities like *Minecraft* and *Portal*. These often take some time for players to get properly oriented so we must be prepared to devote a few classes just to learning how to use the game, with only simple objectives to start.

To be a viable option, these games should have the capability of being a tool, utility, or platform upon which many different kinds of lessons can be built. In a sense, they can be viewed much like a textbook or a lab. Remember that not all students will show the same level of enthusiasm for the tool you are using and it is worth designing some lessons that use alternate approaches because even good games can become monotonous if used all the time.

Zooming out to a course or grade-long scenario, our approach to the design of the plan changes from the style used for the lesson and unit plans to something more like a syllabus. The value of creating a game based syllabus is that we will be able to see at a glance how much use we will make of the game. It helps balance the game-based learning with other approaches because while game-based learning can be a very useful approach, it should not be the only one.

We should be able to look at the course plan and have a solid idea about how much of the student's assessment will depend on the game as well as how often it will be used. This will help us to plan access to the necessary technology as this may need to be coordinated with other courses and teachers. This is, however, one place where the lower elementary grades often differ from the upper elementary grades and higher education. Lower grades typically have one teacher for the class who manages all of the subjects, whereas the upper grades tend to have subject specialists. One implication is that a semester, course, or year plan may benefit from the combination of multiple subjects, which in the lower levels is considerably easier to manage than in the higher ones. As a result, our semester template is going to be less structured than the others—we will focus here only on those aspects that relate to game use.

10.7 Template: Semester

This template also starts with some basic organizing information, just like the others. The next section is organized in much the same way as the unit plan, but the perspective is longer term and may include multiple units.

General Overview and Goals: Give a brief overview of the course, like one might find as a calendar entry at university. Again, if we are writing this for an elementary grade, it might be sufficient to say that this is Grade 1 science, for example. Are there any key concepts, skills, and/or understandings that students should get out of this course?

Game Overview:

- Provide a brief description of the game to be used and how it will be used during the course.

- Will it be used for everything, or just occasionally?
- You might want to refer to the list of 15 Ways to Use Games to outline how the game will be used in this course.

  Game Rationale: Briefly explain how this game fits in with the course.

Prerequisites:

- Are there any prerequisites for this course? If so, say what they are.
- What, if any preparations are necessary for the game?
- Will the students already be familiar with it or do we assume we are starting from scratch?

Learning Outcomes:

- If there are prescribed learning outcomes, list them here. They can be summarized with a reference to the full list (provide a link or say where the document can be found). Include version information so we can track changes as necessary.

Instructional Methods:

- The unit and lesson plans are where we provide details on exactly what we plan to do where.
- Here we list the general strategies that we will use throughout the term.
- This list is not meant to be restrictive, so strategies can be added or changed as necessary. Rather, it is meant to help us get an overview of the kinds of approaches we plan to take, and also to ensure we will have sufficient variety over the term.

Evaluation Procedures: Here too we are providing an overview rather than minute details. This will help us organize and target the activities and assessments in each unit to ensure balance.

Preparation Required:

- Is there something you need to do before the course starts?
  - Are there any supplies or other materials you need to gather or order?
  - Do you need to inform anyone else (such as the librarian) so they can have things ready that you will need?
  - Does the game need to be purchased/updated/installed somewhere?

    Are there licensing concerns to be dealt with?
- If there are links to communities, web pages, or other resources, these should be checked to make sure they still exist.
- If you have downloaded or printed copies of documents or other items, it might be a good idea to check them to make sure they are still available and to see if they have been changed.

Unit Plans: This section lays out the instruction, unit by unit. It is presented in tabular form so it is easier to see as a whole. Use as many lines for each unit as necessary. Ideally each distinct theme would have its own line, as would each distinct activity.

- **Time**: During which week(s)/month(s) is this unit taught? They should be listed in chronological order as far as is possible. Adding a time duration helps to give the unit context and scope.
- **Topic/Theme**: What is the major focus of this unit?
- **Activity**: Each distinct activity should have its own line, whether it is assessed or not.
- **Game Use**: Will the game be used here? If so briefly state how.

10.7.1 Semester Plan: Grade 1 Science with Minecraft

Minecraft, Science, Grade 1

Minecraft is a multiplayer, open-ended virtual world where players can build almost anything and allow others to interact with what they have built. Everything in this world is built out of square blocks that can have various properties, including different colors and patterns. It is relatively easy to learn how to build things, which makes it a good candidate for a first grade class. The fact that the basic building material is a meter square block makes it ideal for counting and measuring. The example that follows is a yearlong plan for a grade one math class that includes the use of *Minecraft* as an environment where students can build, explore, and experiment with the concepts they are learning. Note that the game is not the only tool to be used in this class. The game is used in addition to more traditional approaches and is not really replacing any. This plan is adapted from an existing grade one and two math plan (Morris, 2011).

10.7.2 Videogame Long-Term Planning Template

Adapted from Lesson Plan document created by Brittainy Morris at Living Sky School Division No. 202, North Battleford, Sask. (Morris, 2011)

Title	Math with Minecraft time: 10 months				
Name:	K. Becker	*Subject*(*s*):	Math	*Grade*(*s*):	1
Game:	Minecraft	*Used as*:	Environment		

General Overview and Goals: *Grade 1 Math* is based around creating a deep understanding of basic math concepts. Most of the program is based around using Minecraft and physical manipulatives and objects to simulate problems and actualize math concepts. Students will be asked to share their understanding on a regular basis through large and small group discussions and journaling. Students will also have regular practice through building activities in Minecraft, writing activities, and other games. Students will also be asked to find real-life uses and connections for math concepts.

Game Overview: *Minecraft* is a multiplayer environment where students can build almost anything they want using blocks.

Game Rationale: Minecraft allows us to create models and examples that students can share with the teacher and each other. It provides an additional venue for visualization and actualization of concepts using an environment that's fun and very flexible. The educational version allows teachers to track what the students are doing and to create a variety of assessments within the game itself.

Prerequisites: None.

Learning Outcomes:

Students will be able to:

- Write and recognize numbers and associate a value with that number
- Actualize math equations and number sentences through the use of manipulatives
- Use problem solving strategies to solve math questions especially those applicable to everyday life
- Discuss math concepts to further their own understanding of the material
- Express their understandings of math concepts in their own words
- Do basic addition and subtraction questions
- Use simple measurement techniques for linear measurement
- Write neatly and legibly in their math books
- Create and talk about models built in Minecraft and relate them to the concepts being learned
- Recognize the importance of math in their life
- Work independently and cooperatively to solve problems

Instructional Methods:

- Daily math meeting to discuss mathematical concepts and new vocabulary while explaining the daily lesson
- Daily group counting using a pocket chart with numbers 1–100, fishbowl for counting by 10's, and popsicle sticks
- Weekly Minecraft sessions to create models of concepts (building examples, creating demos, presentations).
- Use of vocabulary chart for new words
- Group work to discuss and share ideas about lesson
- Use of manipulatives such as base 10 blocks, coins, counters, and geometric shapes to actualize concepts
- Drill and practice using workbook and additional work sheets
- Supplemental learning activities through file-folder games and free time books

Evaluation Procedures:

• Observations and checklists	10 %
• Student–teacher conferences	10 %
• Daily work	50 %
• Activities (centers, projects)	20 %
• Quizzes	10 %

Preparation Required: Will need to set up a variety of stations in Minecraft where students can go and do activities.

Unit plans:

Unit #	Time	Topic/theme	Activity	Game use
1.	Sept.	Sorting	Sorting items into similar groups.	Sort preexisting blocks. Create sorting games for themselves and others.
2.	Oct.	Counting and Number Sense	writing, counting, recognizing 1–10	Labeling groups of items.
3.	Nov.	Addition	To 5	Manipulating groups of items.
4.	Dec.	Subtraction	To 5	Manipulating groups of items.
5.	Jan.	2D Shapes	Creating, comparing, identifying	Using single layers of blocks to create shapes that can be viewed and identified from above.
6.	Jan.	Measurement	Linear Measurement	Measuring existing structures.
7.	Feb.	Counting and Place Value	1–20	Labeling groups of items.
8.	Mar.	Adding and Subtracting	To 10	Manipulating groups of items.
9.	Apr.	3D Shapes	Creating, comparing, identifying	Using multiple layers of blocks to create shapes that can be viewed and identified from various viewpoints.
10.	May to June	More Adding and Subtracting	To 20	Manipulating groups of items.

Reflections/Revisions (if necessary, continue on separate sheet)
None yet.

10.8 Summary

In this chapter, we dissect the anatomy of a lesson plan and create a couple of sample plans using the games we analyze in Chap. 7. We also look at what else is needed if we want to plan a complete unit or even use a game over an entire semester or course and looked at an example of each. There is of course, always more to learn, and the field of game studies continues to evolve at breakneck speeds, but with these templates we now have the basics of everything we need to know to plan and make effective use of games in the classroom. These templates can't guarantee that we won't encounter any problems, but with a careful record of what we plan to do and clear reflections on what went well and what needs to be changed, we have the best chance possible.

That brings us almost to the end of this volume. Just like in our lessons, this is the time to reflect on what we've learned, where we want to go from here, and what we still need to learn to get there.

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Chapter 11
End Game

> *It's misleading to suppose there's any basic difference between education & entertainment. This distinction merely relieves people of the responsibility of looking into the matter.*
>
> *Marshall McLuhan, from "Classroom without Walls," Explorations Vol. 7, 1957*

This book examines what games are, how they work, and how to use them in educational settings. It has shown how to create lessons, units, and entire courses, and has provided a wide variety of practical ideas for how to use them in our classrooms, along with some examples. It is silly to imply that this is all you need do to ensure the games you choose are going to be perfect for you needs, or that using these templates will ensure that all of your students meet all of the required learning objectives and love you besides. Try as we might we still have no sure fire formulas for writing a guaranteed best-seller, or creating a blockbuster movie, or creating a perfect lesson but the tools and techniques introduced in this book will certainly set you along the right path. After reading this book, you will be able to examine a potential game in a structured way and you'll be able to articulate why it's good for your purposes, or why it isn't. After reading this, you'll be able to take a game and identify where it will need more teacher input and also where students will need more help in the lessons that use it. By using the templates, a teacher should be able to create lessons that include the use of games as a deliberate and integral part of your lesson, rather than an afterthought or add-on.

That's progress.

11.1 Embracing the Opportunities

To misquote Ralph Waldo Emerson:

> We, as we (play), must become Greeks, Romans, Turks, priest and king, martyr and executioner, that is, must fasten these images to some reality in our secret experience, or we shall see nothing, learn nothing, keep nothing.

K. Becker, *Choosing and Using Digital Games in the Classroom*, Advances in Game-Based Learning, DOI 10.1007/978-3-319-12223-6_11

Games can allow us to be things and do things that can't be done otherwise—at least not nearly so safely and inexpensively. With the growing acceptance of games in the classroom, we are in a time of exciting possibilities. Many games use the same sorts of techniques we recognize as sound pedagogy, even if they weren't designed that way deliberately. The dots connecting what is done in games and what is accepted as good instruction are increasingly connected. After reading this book, you should better understand that games will not necessarily make your work easier. In fact, using them likely means more work in the short term; but, the potential payoff with engaged students that are excited to learn makes it worth it. Furthermore, continuing to assess the games used and sharing insights and support materials can move us towards an ideal of game-based learning and pedagogy as one more positive teaching tool in our educational toolset.

The text covers 15 different ways to use games in the classroom and over 100 different instructional strategies. From these, even if a teacher lacks the latest and greatest technology, games can still work in the classroom. Some strategies don't even require us to have or play the game in class. These lists will grow as we continue to gain experience so the possibilities for ways to engage with games in the classroom are ultimately as numerous as the teachers who use them.

In order to do that we must not only be prepared to create game-based lessons, we must also be prepared to invest the time to get to know our tools. Unless the game is a simple drill and practice kind of game teachers will need to take the time to learn the game. We do this with the other tools we use in the classroom, from novels and textbooks to lab equipment. We should expect no less from games.

I live in a relatively rural area where many people raise cattle and have horses. When my oldest son was in grade two, he had a teacher who just loved barrel racing. Almost everything she did in class had something to with barrel racing. Some kids seemed to like it, but others, like my son, who was allergic to horses, did not. Not all activities work for all learners. In keeping with this, we must be careful not to embrace any single domain or tool, as we are likely to disengage those students who don't share a passion for our favorite topics and tools. While games can be extremely valuable in the classroom, they should not be the only tools we use.

On the other hand, games can also help provide students with variety and, for some kids, this can make a significant difference. When I was in school, the only projects that interested me were ones that had to do with animals; but, I also loved games—and this was when the only kinds of games we had in the classroom were non-digital ones.

11.2 Addressing the Challenges

> We need to consider whether we are educating children for their futures or our pasts.
> Geoff Southworth 2002

The future with games for learning is not all rosy as some challenges remain. There's an old adage called Sturgeon's law that states that 90 % of everything is crap. Unfortunately, games are not an exception. There are many reasons for this, but a key reason is that making a good game is *hard*. If we now add to that the requirement that it be an educational game the challenge is even greater, because designing good lessons is also hard. Together, the difficulty is multiplicative rather than additive. It is not enough to be an instructional designer However, keep in mind that many less than stellar games still have redeeming features, although not all. As with the *Osy Osmosis* example, we can create a good lesson using a flawed game.

As shown in Chap. 8, the so-called digital natives aren't always what they appear. They may have grown up with advanced technologies like computers and smartphones and are as comfortable with as the previous generation was with telephones and televisions. However, that does not mean they understand the technology well, any more than the previous generation understood the telephone or television. Just because they know how to send photos through their phones and post things on Facebook does not mean that they know what happens after they hit *send* or *post,* nor do they always understand the ramifications of their actions. Even things as seemingly ubiquitous as Microsoft Word or PowerPoint are worthy of more time and attention than most people give them. In order to use a tool well, one must learn how it works well. I have lost track of how many times I have had to teach basic word processing skills to freshman university students—all of whom assured me they knew how to use that applications.

Also of central importance is the hardware or equipment. Hardware challenges aren't going away any time soon, and even if you have the luxury of one-to-one laptops or mobile devices, it is still important to check that the game will run smoothly on the hardware you will be using. If you need to book the school's computer lab, or even if there is only one computer in your classroom that can be projected on a screen for the class, you can still bring games in to the classroom, but you will need to make doubly sure that your instructional strategies take this into account and that you have contingency plans in place.

Contrary to popular myth, we can't assume everyone will like your lesson just because you are using a game. Some kids don't play many games, and a few don't play them at all. Some may even resent the fact that teachers are using their favorite out-of-school activity in school. As with other lessons, be prepared to tell them why they are doing it and what they should get out of it. The notion of "stealth learning," which some view as "tricking people into learning" is, in my opinion, disingenuous. Most students will appreciate honesty more than stealth.

While we're on the subject of assumptions, when preparing lessons, don't assume all of your students know how to play videogames—many are not as familiar as one would hope (Pittman, 2013). It can be discouraging to have to struggle with a game in order to get at the learning (Barr, 2015) so it is important to allow time for students to become familiar with the game. Be cognisant that some students may be quite familiar with a particular game or genre, while others are not. One way to address this is to balance player experience by pairing up more and less experienced players, at least at the beginning, until everyone is in pretty much the same place (Barr, 2015).

Some great games have little or no teacher support. Developing lessons that use games take time (Felicia & Egenfeld-Nielsen, 2011), even when the teacher support is good. If it's not good, it will take even more time. If you're pressed for time, you are probably better off using a more traditional technology. A lecture, textbook, worksheet, or activity that is robust and well-designed is better than a game-based lesson that isn't.

There are other challenges as well, but the last on the current list is that of teacher training in the theory and practice of using games for learning. Teacher training programs need to devote more time to game-based learning and pedagogy, which of course, also means that the people who teach the teachers must also learn about DGBL and GBP. There are a growing number of education programs that offer courses or parts of courses in game-based learning and, over time, faculty at these institutions who are not already involved in game research should become more familiar with the field. In the meantime, professional development for both teachers and university faculty should include such things as games literacy, game-based learning, and game pedagogy on their agendas.

11.3 The Next 10 Years

> We cannot teach people anything; we can only help them discover it within themselves.
> Galileo Galilei

We've come a very long way since Ben Sawyer coined the term Serious Games (Sawyer, 2003), marking the beginning of the second age of computer games in schools with the first being the edutainment era of the 80s and 90s. Games for learning are increasingly accepted and, in some cases, actively embraced. The future really looks bright, but it's crucial that we do it right this time.

Why should we use games? Well, it's NOT because of the digital natives because there is evidence to suggest that today's students still learn much the same way we always have (Margaryan, Littlejohn, & Vojt, 2011). Although games can often be more engaging than other forms of instruction, it is because they are compelling activities, not because today's kids are different than we were. In the end, we should use games because good ones are grounded in sound pedagogy and careful instructional design can bring out the bloom[1] (pun intended) in almost any game. A good lesson is more than the sum of its parts, and sound design is important—both for the game and for the lesson.

As for research on game-based learning and pedagogy, the field is getting better at studying learning games. It is therefore likely that future studies will produce best practices and help us get a better handle on which games to use where, when, and how (Felicia & Egenfeld-Nielsen, 2011). This will help us build even better games and even better lessons using them.

As you proceed along the path to becoming a game-based teacher, don't be afraid to ask for help. According to Roger's theory of innovation, there are five stages to adoption:

1. Knowledge, where people become aware of the innovation.

[1] A popular depiction of Bloom's taxonomy is as a flower (Wikipedia Contributors, 2016).

2. Persuasion, where people begin to think about how the innovation might work for them.
3. Decision, where people decide to either adopt the innovation, or reject it.
4. Implementation, where the innovation is introduced into daily practice, and
5. Confirmation, where people confirm their choice (Rogers, 1962, 2003).

In their study of teachers' adoption of game-based pedagogy, Emin-Martinez and Ney (2013) found a close mapping between Roger's five stages of adoption and the practices of the teachers they studied. There was a stage of GBP adoption that matched Roger's five stages:

1. Knowledge: In this stage teachers acquired a growing awareness of game-based teaching and pedagogy. Some began to collaborate with teachers who were using DGBL and GBP.
2. Persuasion: Here teachers began to expand their knowledge of DGBL and GBP through readings and other research. If this volume had been available at the time of the study, they might have read this book. This is the stage where teachers become convinced (or not) of the value of DGBL.
3. Decision: This is where teachers begin to examine and analyze games in more detail. They may even test games on some of their students. The outcomes of these tests and analyses will ultimately determine whether or not they decided to pursue GBP or not.
4. Implementation: Assuming they have decided to adopt GBP, this is the stage where they begin to use or adapt game-based lesson plans that have been made by others or develop their own (again, this book can help here).
5. Confirmation: At this point teachers will either become uncomfortable with their choice, in which case they may decide to reject GBP or to continue on. In either case, the decision is made from actual experience and so is likely to result in a better fit (Emin-Martinez & Ney 2013).

11.4 Last Words

Just like reading classic works of literature can help you become a better novelist, examining and playing games can help expand your horizons and provide insights into other ways games can be used for teaching and learning. With a critical eye, you can better examine both entertainment and learning games and find even more ways to use them in the classroom.

I leave you then, with these wise words to ponder as you continue to explore the potential of games in the classroom.

> The will to learn is an intrinsic motive, one that finds both its source and its reward in its own exercise. The will to learn becomes a "problem" only under specialized circumstances like those of a school, where a curriculum is set, students are confined, and a path fixed. The problems exist not so much in learning itself, but in the fact that what the school imposes often fails to enlist the natural energies that sustain spontaneous learning.
>
> (Bruner, 1966, p. 127)

Perhaps a fitting way to bring this volume to a close is with a brief commentary on comments made by Marshall McLuhan in Understanding Media (1964). He devoted an entire chapter to a discussion of games, though he could not have known of the coming videogame revolution—his book was published in 1964—just about the time the very first computer games were being written. He wrote his chapter primarily in reference to traditional games and sports, though his description of games as a "kind of model of the universe" (p. 236) could not have been more apt had he written it with hindsight today. McLuhan also described games as "dramatic models of our psychological lives," "dramatic enactments of a cosmic struggle" (p. 237). "That games are extensions, not of our private but of our social selves, and that they are media of communication, should now be plain. Games are situations contrived to permit simultaneous participation of many people in some significant pattern of their own corporate lives" (p. 245).

If McLuhan is right, and games are a means to retribalize a society long accustomed to industrialization and factory-style schooling, then games could easily be an important part of the solution to improving education for the twenty-first century.

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Chapter 12
Supplementary Materials

12.1 Twenty Learning Theories Embodied in Games

This final chapter contains summaries of the major lists from the book. The learning theories, instructional theories, instructional design models, and the 15 ways to use games are summarized for easy reference. The 101 instructional strategies are presented in a table sorted alphabetically and crossreferenced by their section numbers in Ch. 9. This chapter also contains lesson plan, study guide, and teacher's giude templates that can be copied and adapted to the needs of the user.

12.1.1 Behaviorist

These theories hold that all behavior can be shaped by associating a desired response with a specific stimulus

Classical Conditioning
Key Contributor(s): Pavlov (1927)
Brief Synopsis: In classical conditioning two different stimuli are presented, one that will elicit a desired response (SC) and another that doesn't (SU). If this sequence is repeated often enoug h, the second stimulus (SU) becomes associated with the response and ultimately can elicit the desired response without the first stimulus (SC).
Keywords: Stimulus, Response

Operant Conditioning
Key Contributor(s): Skinner (1938)
Brief Synopsis: (1) Show stimulus, (2) Get response, (3) Reward or push them, depending on how response compares to desired action.
Keywords: Stimulus, Response, Reward, Punishment, Extinguish

K. Becker, *Choosing and Using Digital Games in the Classroom*, Advances in Game-Based Learning, DOI 10.1007/978-3-319-12223-6_12

Connectionism
Key Contributor(s): Thorndike (1910)
Brief Synopsis: S-R connections can be chained together. Transfer of learning will occur in subsequent actions because of the previous associations.
Keywords: Readiness, Exercise, Effect

Conditions of Learning
Key Contributor(s): Gagné (1965)
Brief Synopsis: There are eight different types of learning, and each one requires a different approach. They are: Signal Learning, Stimulus-Response Learning, Chaining, Verbal Association, Discrimination Learning, Concept Learning, Role Learning, Problem Solving.
Keywords: Conditions of learning, transfer of learning, Chaining, instructional event, diversity, Reinforcement

12.1.2 Cognitivist

Theories that address how learning is affected by the workings of the brain and how people think.

Schemata
Key Contributor(s): Piaget, Bartlett (1932)
Brief Synopsis: A mental framework for making sense of the world. Things we can connect with existing schema are more easily learned than things that are entirely novel.
Keywords: Scaffolding, Patterns

Cognitive Development
Key Contributor(s): Piaget (1969)
Brief Synopsis: Cognitive development follows a predictable pattern determined by age. New learning goes through a predictable series of processes Piaget called adaptation.
Keywords: Cognitive development, Schema, Assimilation, Accommodation, Disequilibration, Equilibration, Sensorimotor period, Preoperational period, Concrete operational period, Formal operational period

Attribution Theory
Key Contributor(s): Weiner (1974)
Brief Synopsis: People will attribute causes to actions, depending on the degree of control they perceive they have over the action.
Keywords: Self-ascription, External attribution, Internal attribution, Self-attribution, Motivation, Ability, Effort, Difficulty, Chance

Cognitive Apprenticeship
Key Contributor(s): Vygotsky (1978), Collins, Brown, and Newman (1987)

Brief Synopsis: An application of the traditional apprenticeship model applied in the cognitive domain—coaching thinking.
Keywords: Learning by doing, Cognitive apprenticeship, Authentic practices, Exploration, Active learning, Active thinking

Cognitive Load Theory
Key Contributor(s): Sweller (1988)
Brief Synopsis: We have a limited capacity for attention and learning splits that capacity across three categories (extraneous, intrinsic, germane). Maximizing the attention available for germane learning also maximizes learning.
Keywords: Extraneous, Intrinsic, Germane

12.1.3 Social Learning

Learning that happens in social contexts—normally with other people, but also mediated by technology.

Social Learning Theory
Key Contributor(s): Bandura (1977)
Brief Synopsis: Learning by observing others modeling behaviors.
Keywords: Social learning, Modeling, Observation, Imitation, Self-regulation

Social Development Theory
Key Contributor(s): Vygotsky (1962)
Brief Synopsis: ZPT is the area of capabilities that learners can exhibit with support from a teacher or peer. Scaffolding is the support given during the learning process which is tailored to the needs of the learner with the intention of helping the learner achieve his/her learning goals.
Keywords: Social culture, Social development, Zone of proximal development, Scaffolding

Social Constructivism
Key Contributor(s): Vygotsky (1934), Dewey (1963)
Brief Synopsis: A theory of how meaning is constructed through shared ideas and experiences.
Keywords: Meaning making, Shared experiences

Situated Learning
Key Contributor(s): Lave and Wenger (1990)
Brief Synopsis: Learning is a social process whereby knowledge is co-constructed and is situated in a specific context and embedded within a particular social and physical environment.
Keywords: Authentic activity, Learning situation, Situated learning, Apprenticeship, Legitimate peripheral participation, Meaningful learning, Socially shared, Distributed

12.1.4 Constructivist

Constructing meaning is central to learning. The learner is not a passive recipient of knowledge, but that knowledge is actively constructed by the learner. (Piaget; Bruner)

Actor–Network Theory
Key Contributor(s): Callon, Latour, Law (1987)
Brief Synopsis: No-one acts alone; we are all part of a network. It addresses interactions between humans and technology.
Keywords: Actor–network, Actors can be human or nonhuman

Discovery Learning
Key Contributor(s): Bruner (1960)
Brief Synopsis: Learners construct knowledge by forming and testing hypotheses.
Keywords: Inquiry-based instruction, Prior knowledge, Discovery learning, Trial and error

Activity Theory
Key Contributor(s): Vygotsky (1977), Leont'ev (1978), Luria (1976)
Brief Synopsis: The interrelationship between the learner, the objectives, and the tools are culturally mediated.
Keywords: Activity system, Action, Dynamic relations, Mediated, Structure, Subject, Objective

Constructionism
Key Contributor(s): Papert (1980)
Brief Synopsis: Learning through actually building things.
Keywords: Building, Makers

12.1.5 Humanist

Humanism uses the perspective of human potential for growth. It rejects the notion that behavior is predetermined (as behaviorists do) or that it is determined by environment or the subconscious. It assumes that people are inherently good and will strive to better themselves and their environment.

Experiential Learning
Key Contributor(s): Kolb (1984)
Brief Synopsis: Knowledge is continuously gained through both personal and environmental experiences. The learner must:

1. Be able to reflect on the experience
2. Use analytical skills to conceptualize the experience
3. Make decisions and solve problems to use the ideas gained from the experience

Keywords: Experiential learning, Learning cycles, Learning style, Concrete experience, Reflective observation, Abstract conceptualization, Active experimentation, Diverger, Assimilator, Converger, Accommodator

Maslow's Hierarchy of Needs
Key Contributor(s): Maslow (1943)
Brief Synopsis: People's needs are hierarchical and basic needs (food, shelter, love, etc.) need to be met before learning can occur.
Keywords: Self-actualization, Esteem, Belongingness, Safety, Basic needs

Self-Determination Theory
Key Contributor(s): Deci & Ryan (1972)
Brief Synopsis: People are motivated by endeavors that satisfy the basic needs for autonomy, competence, and relatedness.
Keywords: Competence, Autonomy, Relatedness

Flow Theory
Key Contributor(s): Csikszentmihalyi (1991)
Brief Synopsis: Flow is a state of immersion in an activity that is satisfying and that focuses our attention.
Keywords: Attention, Pleasure

12.2 Fifteen Instructional Theories Embodied in Games

12.2.1 Didactic

These theories provide a framework for instruction. They are prescriptive in that they outline what needs to be done, often in what order, but they are not design models in that they don't provide the process for actually creating the designs.

Gagné's Nine Events
Key Contributor(s): Robert Mills Gagné (1965)
Brief Synopsis: An ordered series of nine elements that compose a lesson.
Keywords: Reception, Expectancy, Retrieval, Selective perception, Semantic encoding, Responding, Reinforcement, Expectancy, Generalization

Elaboration Theory
Key Contributor(s): Reigeluth (1983)
Brief Synopsis: A theory of organizing instruction to facilitate the development of meaningful contexts to connect new skills and ideas.
Keywords: Simple to complex, Learner centered, Elaborative sequence, Prerequisite sequence, Synthesis, Analogies, Cognitive strategies, Learner control, Elaboration

Merrill's First Principles
Key Contributor(s): Merrill (2002)
Brief Synopsis: Five fundamental elements that all instruction must possess.
Keywords: Problem, Activation, Demonstration, Application, Integration

12.2.2 Instructionist

Often associated with behavioral training. They tend to be algorithmic in style outlining a set pattern to follow.

Spiral instruction
Key Contributor(s): Bruner (1960)
Brief Synopsis: start with concrete/hands on/demonstrations and then progress to more abstract aspects of the topics.
Keywords: Symbolic, Iconic, Enactive

Programmed instruction
Key Contributor(s): Skinner (1954)
Brief Synopsis: A structured series of activities that can often be completed independently. Progress is usually administered via assessment results.
Keywords: Sequence material, Individualized instruction, Feedback, Initial behavior, Terminal behavior, Self-learning

Direct instruction
Key Contributor(s): Zig Engelmann in 1960s (Engelmann & Carnine 1982)
Brief Synopsis: A teacher-led approach where learners are told what they should know. A common form is the lecture, but can also include guided practice.
Keywords: Direct instruction, Feedback, Prior knowledge, Specific teaching goal, Distributed practice, Guided practice, Closure, Independent practice

12.2.3 Bricolage

Bricolage is used here as a category of approaches rather than as a specific design theory. The theories/models in this group are here because they are strongly influenced by what is at hand.

Problem-based learning
Key Contributor(s): None. Originally from medical school in 1960s.
Brief Synopsis: A structured approach to solving problems. Often used with case and scenario based learning.
Keywords: Problem-based, Authentic (real world), Problem solving, Teacher as facilitator, Learner centered, Problem statement, Hypothesis, Data requests, Learning issues, Closure

Situated Learning
Key Contributor(s): Lave (1991)
Brief Synopsis: Instructional approach to facilitate situated learning opportunities.
Keywords: Concrete experiences, Reflective experiences, Abstract conceptualization, Active experimentation

Discovery Learning
Key Contributor(s): Bruner (1960)
Brief Synopsis: Learners obtain knowledge by forming and testing hypotheses.
Keywords: Inquiry-based instruction, Prior knowledge, Discovery learning, Trial and error, Experience, Reflect, Abstract/generalize, Transfer

12.2.4 Hermaneutic

The next category is hermaneutic theories, which are those that describe systems or environments for instruction. They focus on the context rather than the procedure.

Activity Theory
Key Contributor(s): Vygotsky (1977), Leont'ev (1978), Luria (1976)
Brief Synopsis: Instructional approaches that facilitate the interrelationship between the learner, the objectives, and the tools are culturally mediated.
Keywords: Activity system, Action, Dynamic relations, Mediated, Structure, Subject, Object, Tools, Rules, Community, Division of labor

Constructivist Learning Environments
Key Contributor(s): Jonassen (2004)
Brief Synopsis: Eight interconnected essential qualities of a learning environment that promote constructivist learning.
Keywords: Constructive, Collaborative, Conversational, Reflective, Conceptualized, Complex, Intentional, Active/manipulative

ARCS
Key Contributor(s): Keller (1970s)
Brief Synopsis: Four major categories of motivation that can be influenced by specific instructional strategies.
Keywords: Attention, Relevance, Confidence, Satisfaction

12.2.5 Cognitive

Organizing instruction to facilitate cognitive processes.

Advance Organizers
Key Contributor(s): Ausubel (1978)

Brief Synopsis: A form of scaffolding that can help learners connect new knowledge with existing knowledge.
Keywords: Expository, Narrative, Skimming, Graphic

Information Processing
Key Contributor(s): Miller (1956)
Brief Synopsis: A theory that explains how the different kinds of memory are related and how information can pass though them.
Keywords: Sensory memory, Short-term memory, Long-term memory, Stimuli, Response, Rehearsal, Retrieval, Transfer

Cognitive Apprenticeship
Key Contributor(s): Collins & Brown (1987)
Brief Synopsis: A cognitive variation on traditional apprenticeship where the learner is coached on how to learn something.
Keywords: Apprentice, Modeling, Approximating, Fading, Self-directed learning, Generalizing

12.3 Twelve Instructional Design Models for Using Games in the Classroom

12.3.1 Generalist Models

Generalist ID models are high-level models that outline the general principles of what's involved in I.D. without really providing any details.

A.D.D.I.E.
Key Contributor(s): unknown
Brief Synopsis: A five phase model that proceeds in a relatively cyclical fashion with evaluation and testing at the central core. Many other models are either based on this one or have these phases as part of their process.
Keywords: Analysis, Design, Development, Implementation, Design and testing

Design by Query
Key Contributor(s): Becker (2002)
Brief Synopsis: A list of guiding questions is generated, then ranked. Questions are addressed using a scrum approach.
Keywords: Scrum, Guiding questions

Merrill's First Principles
Key Contributor(s): Merrill (2001)
Brief Synopsis: Five fundamental elements that all instruction must possess. Used as an ID model it serves as a checklist to ensure the fundamental elements are all addressed.
Keywords: Problem, Activation, Demonstration, Application, Integration

12.3.2 Agile Models

The "agile" models are ones that include a fairly high level view of the design process and are meant to allow for a flexible approach. They tend to show a minimum number of steps or phases.

Wiggins & McTighe
Key Contributor(s): Wiggins & McTighe (1998)
Brief Synopsis: A simple model that begins at the end by deciding what learners should know, then determines how we will know they know it, and finally focuses on creating the instruction to effect that.
Keywords: Desired results, Acceptable evidence, Learning experiences

Rapid Prototyping
Key Contributor(s): Tripp (1990)
Brief Synopsis: This approach advocates the creation of a functional, if incomplete version of the solution be created as soon as possible and it is this prototype that forms the focus of the design process. The actual design phase is in fact a fairly tight cycle of design–build–test–adapt.
Keywords: Prototype, Build, Install and maintain system

Hannafin & Peck
Key Contributor(s): Hannafin & Peck (1988)
Brief Synopsis: A simple model that breaks up the design process into three distinct phases: needs assessment, design, and development that requires evaluation and revision at each phase. It is possible to revert to a previous phase after any evaluation.
Keywords: Needs assessment, Design phase, Development phase

12.3.3 Detailed Models

These include some of the classic instructional design models. They are systematic and detailed, although each one takes a distinct approach.

Gerlach & Ely
Key Contributor(s): Gerlach & Ely (1980)
Brief Synopsis: A model that includes specific mention of some of the practical classroom considerations such as the allocation of time, space, and other resources.
Keywords: Allocation of time, Space, Resources, Entering behaviors, Content, Objectives

Morrison, Ross, and Kemp
Key Contributor(s): Morrison, Ross & Kemp (2004)

Brief Synopsis: A systemic model that recognizes a nonlinear approach to ID. Includes focus on learner characteristics, content sequencing, message design, and support services.
Keywords: Instructional problems, Learner characteristics, Task analysis, Content sequencing, Message design, Support services, Evaluation instruments

Dick & Carey
Key Contributor(s): Dick & Carey (2001)
Brief Synopsis: A largely linear model well suited to use by novices in the design of instruction where media do not play a central role.
Keywords: Instructional systems design, Performance objectives, Formative evaluation, Summative evaluation, Revision

12.3.4 Applied Models

Applied models approach instructional design using specific technologies. There are many forms of ID that are applied, but only those associated with games are included here.

Serious ID
Key Contributor(s): Becker (2011)
Brief Synopsis: A design model for serious games that takes the learning objectives and simulation aspects of serious games into account.
Keywords: Discovery, Conceptual model, Operational model, Prototyping, Playtesting, Validation, Verification

Gamified ID
Key Contributor(s): Becker (2014)
Brief Synopsis: A model for Developing instruction that is gamified. It allows for flexible paths, the creation of quests, and the design of appropriate reward structures.
Keywords: Learning path, Mise-en-scène, Quests, Narrative

Game-Based Learning ID
Key Contributor(s): Becker (2015)
Brief Synopsis: Model specifically design for game-based learning. It takes the choice of game into account and provides for design around the game sessions. It includes predictive evaluation of the game.
Keywords: Mise-en-scène, Game

12.4 Fifteen Ways to Use Games in the Classroom

This list is a quick reference summary of 15 ways that games can be used in the classroom. For a more detailed explanation, see Chap. 9.

Game as:

1. **Content**
   The content of the game directly addresses some curricular need.
2. **Process**
   The process of the game connects with a broader curricular objective.
3. **Example**
   In this case the game is being used as an example of or an artifact that supports what is being taught.
4. **Counter-Example**
   The game contains artifacts or concepts that are incorrect, inconsistent, or is in some other way a counter-example of something that is being taught.
5. **Inspiration**
   Games can be used as inspiration for creative writing, for construction, as examples of scenarios, or as role models.
6. **Literature**
   Games can offer unique perspectives on story, narrative, character development, and other aspects of literature.
7. **Art**
   Some games have a unique artistic style that is worth studying.
8. **Music**
   There are many aspects of video game scores that are worthy of study, from looking at examples of exceptional musical scores, to how the music enhances or detracts from the activity in the game, to various approaches to repetition.
9. **Lesson Opener**
   A game trailer or a short form game can be used to begin a lesson, as an advance organizer or to set the stage for the lesson that follows.
10. **Homework**
    Students could be asked to play a particular game out of class time and to collect data, answer questions, or in some other way prepare for something that will be addressed in class.
11. **Medium**
    This is the constructionist approach to learning by making a game about the topic or concept being taught.
12. **Environment**
    Sometimes a game can provide an environment for some activity or part of a lesson, even if it does not address the curricular needs directly.
13. **Virtual Environment**
    Using a game as a way to do something that is otherwise impossible is a special case of using a game as an environment—doing the impossible.
14. **Optional**
    A game could be offered as one of several ways to complete some assignment or other work.
15. **Pastime/Reward**
    Last but still not least is the use of games as a reward for good behavior or the completion of other work.

12.5 One hundred and One Instructional Strategies for Use with Games

This list is a quick reference summary of 101 strategies for using games in the classroom. For a more detailed explanation, see Chap. 9, where they are listed alphabetically. The table here categorizes each strategy according to whether it is most useful pre-game, in-game, or post-game. If it is a strategy that spans all three it is noted as a peri-game strategy.

Strategy	#	Pre-game	In-game	Post-game	Peri-game
Game club	42	Social; collaborative		Social; collaborative	Yes
Artifact strategy	10	Research	Targeted gaming	Analysis	Yes
Data analysis	28	Research	Targeted gaming	Analysis	Yes
Experiments	33	Research	Targeted gaming	Analysis	Yes
Independent playing programs	49	Pretest	Targeted gaming	Posttest	Yes
Conflict chart	22	Organizational	Targeted gaming	Reflective	Yes
Field guides	35	Organizational	Targeted gaming	Writing; reflection; analysis	Yes
Field trips	37	Organizational	Targeted gaming	Writing; reflection; analysis	Yes
KWHL	54	Organizational	Targeted gaming	Writing; reflection; analysis	Yes
Paired annotations	62	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
Position paper	65	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
Question the developer	70	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
S.W.O.T. analysis (SWOT)	79	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
Scale models and drawings	80	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
Send-A-Problem	84	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
SOAPSS	87	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
Story maps	88	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
Through the eyes of the enemy	93	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
Value line	94	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
Video	95	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
Who am I? Why am I?	98	Organizational	Conscious gaming	Writing; reflection; analysis	Yes

Strategy	#	Pre-game	In-game	Post-game	Peri-game
Working backwards	99	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
YouTube	101	Organizational	Conscious gaming	Writing; reflection; analysis	Yes
Writing	100	Organizational	Conscious and targeted gaming	Writing; reflection; analysis	Yes
Letters from previous players	57	Organizational		Writing; reflection; analysis	Yes
Structured learning team group roles	89	Organizational			Yes
Completed work chart	20	Anticipatory	Tracking	Reflection	Yes
Predictions	68	Anticipatory	Targeted gaming	Analysis	Yes
Teams-Games-Tournaments (TGT)	92	Anticipatory	Competitions	Reflection; analysis	Yes
Before, during, and after	12	Activate prior knowledge, monitor comprehension	Conscious gaming	Summarize and reflect	Yes
Game box	41				Yes
Interdisciplinary teaching	50				Yes
Journal	51				Yes
Learning contracts	55				Yes
Learning stations	56				Yes
Portfolio	64				Yes
Role-playing	77				Yes
1st TRIP (First TRIP)	1	Start of game; reading preview			
Game pitch	45	Presentation		Presentation	
Game talk	47	Presentation		Presentation	
Muddiest point	59	Organizational	Targeted gaming		
Possible dialog/ possible statements	66	Organizational	Targeted Gaming		
Knowledge rating	53	Organizational			
PROP advance organizer	69	Organizational			
Game kits	43	Experimentation		Experimentation	
Alternative Scenarios	7	Creativity, alternative paths endings and scenarios		Creativity; reflection	

Strategy	#	Pre-game	In-game	Post-game	Peri-game
Cascade	14	Comparative analysis		Analysis; comparative analysis	
Creative problem solving	23	Anticipatory	Targeted gaming		
Collective notebook	18	Anticipatory		Reflection	
Exit/admit slips	31	Anticipatory		Reflection, analysis	
Expectation outline	32	Anticipatory			
AIDA (Analysis of Interactive Decision Areas)	6	Analysis, path planning			
Anticipation guide	8	Activation of prior knowledge, stimulate interest		Comprehension check, correct misconceptions	
Competitions	19		Teamwork		
Action projects	4		Targeted gaming		
AGO (Aims, Goals, Objectives)	5		Targeted gaming		
Checklist	16		Targeted gaming	Reflection	
Collections	17		Targeted gaming		
DPTA (Directed Playing Thinking Activity)	27		Targeted gaming		
Find the fib	38		Targeted gaming		
Find the rule	39		Targeted gaming		
Flow charts	40		Targeted gaming		
Guided practice	48		Targeted gaming		
Olympiads	60		Targeted gaming		
Precision playing	67		Targeted gaming		
Self-selected gaming	83		Targeted gaming		
Supervised practice	90		Supervised gaming		
Shared gaming	85		Social gaming		
Double entry journal	30		Conscious gaming		
Field logs	36		Conscious gaming	Writing; reflection; analysis	
Game logs	44		Conscious gaming		
Justifying	52		Conscious gaming		
Playing out loud	63		Conscious gaming		
SCAMPER	81		Conscious gaming		
Screenshots	82		Conscious gaming		
Shadowing	86		Conscious gaming		

Strategy	#	Pre-game	In-game	Post-game	Peri-game
TAPPS (Thinking Aloud Pair Problem Solving)	91		Conscious gaming		
Walkthroughs	96		Conscious gaming		
What Would X Do? (WWXD)	97		Conscious gaming		
Pair play or team play	61		Collective intelligence		
Apprenticeships	9		Collaboration		
3–2–1 (Three–Two–One)	2			Writing reflection	
Abstracting	3			Summarizing	
Autobiographies	11			Writing; reflection	
Biopoems	13			Writing; summarize; reflect	
Case studies	15				
Compositions	21			Creative writing, music	
Critical incident questionnaires	24			Reflection; teacher feedback	
Critique	25			Reflection; critique; analysis; interpretation	
CROWN	26			Reflection	
Debriefing	29			Reflection, analysis	
Fan fiction	34			Interpretation; creative writing	
Game reports	46			Writing; reflection; analysis	
Machinima	58			Creativity, Writing, Video	
Recall, Summarize, Question, Comment, and Connect (RSQC2)	71			Reflection	
Reflection logs	72			Reflection	
RELATE table	73			Reflection; analysis	
Relay summary	74			Reflection	
Retelling the story	75			Reflection	
Rewrite the Ending	76			Reflection	
Role/Audience/Format/Topic (RAFT)	78			Reflection	

12.6 Single Lesson Plan Template

VIDEOGAME Lesson Plan Template

Adapted from Lesson Plan Template document created by TRU Bachelor of Education program faculty.

This lesson plan is explained in detail in Chap. 10.

Lesson title			Total lesson time	Lesson # of #	Date
Author	Subject	Grade(s)	Game	Used as	

Rationale & Overview:

Prescribed Learning Outcome(s):

1.
2.
3.

Secondary Outcomes:

Instructional Objective(s):

Instructional Strategies:

Prerequisite Concepts and Skills:

Other Materials and Resources:

Teacher	Students

Game:

Description	Curricular ties

Game Requirements (computers and other equipment)

Teacher	Students

Game Resources (websites, communities, teacher and student guides, etc.)

Teacher	Students

Lesson Activities:

Teacher activities and roles	Student activities	Time
Pre-game:		
Game:		
Debriefing:		

Universal Design for Learning (UDL) and Differentiated Instruction (DI):
Organizational Strategies:
Behavioral Management Strategies:
Assessment and Evaluation:

- **Pre-game:**
- **In-game:**
- **Post-game:**

Extensions:
Reflections:

12.7 Unit Plan Template

VIDEOGAME Short Term Planning Template

Adapted with permission from: Unit Plan Template EDPR 3200 4100 4200 @ http://www.tru.ca/hse/education/bed/practica/plans.html

Unit title:	Number of lessons:	Time: (in weeks)
Name:	Subject(s):	Grade(s):
Game:	Used as:	

Rationale:
Unit Overview:
Game Overview:
Prescribed Learning Outcomes (PLO):
Prerequisite Concepts and Skills:
Teacher Preparation Required:
Cross-Curricular Connections:
Extensions to Unit:
Resources:
Overview of Lessons:

Lesson # and title (time in minutes)	PLOs in lesson	Instructional objectives and teaching strategies	Lesson activities	Assessment strategies	Materials (specific to lesson)	Game details

Reflections/Revisions (if necessary, continue on separate sheet)

12.8 Course Plan Template

VIDEOGAME Long-Term Planning Template

Adapted from Lesson Plan Template document created by Shannon McLeod.

Title:	Time:				
Name:		Subject(s):		Grade(s):	
Game:		Used as:			

General Overview & Goals:
Game Overview:
Game Rationale:
Prerequisites:
Learning Outcomes:
Instructional Methods:
Evaluation Procedures:
Preparation Required:
Unit plans:

Unit #	Time	Topic/theme	Activity	Game use
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Reflections/Revisions (if necessary, continue on separate sheet)

12.9 Study Guide Template

There are many resources online that can help you create study guides. What we want to focus on here is a study guide that is designed to help students get the most out of a game. This guide is generic of necessity so some parts may not apply to the particular game you are using. When creating a study guide, just fill in the parts that are appropriate and delete the rest.

You can do it as a Word doc or online as a web page or even an entire website. Your school may have a system for posting to a private or public website or course management system. Even if you opt to have a document that will be handed out, there is an advantage to keeping it in a place that's easily accessible, at least by you. If it is easy to access and modify, you will be more likely to keep it up to date.

Title of Study Guide

Include course, dates, teacher, subject/topic, game, revision #.

Be sure to distinguish between items in your guide that are connected with the study (educational learning) and those that are related to the game (operational learning).

Table of Contents

Have this automatically generated.

Main Keywords:

Include at most eight main keywords—the rest should go into the glossary.

Key Points:

Include at most 5–7 key points.

Overview

This Course/Unit/Lesson is about:

Be sure to include a brief overview of the game and how it supports the educational goals here as well.

Learning Objectives

Outline what it is you intend for the students to get out of this.

Students will be able to:

Symbols, Acronyms, and Abbreviations

Create a sorted list with the meaning for each. There is no need to include definitions—those will go in the glossary.

Prerequisites

What are students expected to know before taking this course/unit/lesson?

Remember to include any prerequisites for the game—should they have played it before? How familiar should they be with the game or the genre?

Tips and Techniques:

Handy ideas for getting the most out of the lesson and your game time.

This also includes any tips for getting the game set up as well as game play—things to watch out for and to be sure to do.

Standards

List the official standards that are addressed by this course/unit/lesson.

This lesson correlates to the following content standards:

Game Notes

This section deals specifically with the game.

Overview

This game is about …

The main object of the game is …

Plot/Narrative

Summarize the game in a paragraph or so.

Key Features

List up to five mechanics in the game that are important to you lesson and note how. This is to help your students play with purpose.

Lesson Notes

Section 1

Include as many of these as appropriate; one for each main topic.
Note which parts of the game, if any, are relevant for this study.

Section 2

…

Glossary

Include definitions for any abbreviations, acronyms, and other terminology associated with the content as well as any game vocabulary that is important to this study.

Resources

Noteworthy people, places, and things associated with the course/unit/lesson as well as with the game. If possible, include a statement or two of explanation for each.

Help

Where to get help for content, game and other tech issues, etc.

Important People and Places

This includes both real life people (living and dead, as appropriate)and in-game characters, as well as both real-life and in-game places that are important to this study.

Internet Sites

Be sure to distinguish between educational sites and those related to the game.

Agencies and Organizations

This includes government agencies and nongovernment organizations (NGOs). Most of these will likely be associated with the content, but if there are any that relate to the game, include those here too. Be sure to annotate, if possible.

Further Reading

This is for resources of all sorts where students can expand on the content if they are so inclined.

12.10 Teacher's Guide Template

The teacher's guide is first and foremost a guide for you and is a place to include information that is related to the game but that isn't directly connected with any specific lesson, unit, or course plan. This is a guide that can be shared with other teachers. As with the other guides, some parts may not apply in every situation so just fill in the parts that apply and delete the rest. As with the study guide, the teacher's guide can be created as a Word doc or online as a web page or even an entire website. If a teacher's guide already exists for the game in question, then reference it and use this guide to add anything that the other missed. This guide can be used for a game specifically designed for learning, or for a COTS game.

General Teacher's Guide Template

Introduction

The Teacher guide has been developed to help you get the most from the game. It explains the learning methodology underpinning the design of the game (as you see it) and the activities that use the game. It is meant to provide guidance in how to use this game as an educational object. The guide identifies which aspects of the Curriculum are addressed by the game and provides general suggestions for assessment. It also explains the computer hardware and software requirements to run the game.

Summary Details of Game:

Game: What is the title of the game? Include an abbreviation if appropriate.

Publisher: This is the company that released the game (e.g., Microsoft, Nintendo, …)

Developer: This is the company or group that actual designed and developed the game.

Release Date: When was the game released? (Usually just the year is good enough).

Genre: Adventure, Shooter, Strategy, Simulation, Puzzle, etc.

Perspective: 2D/3D; Side-Scroller, Top-Down (direct, slight angle, isomorphic), Third-Person, First-Person, Other (explain).

Audience: Who is this game made for?

Subject(s): What subject(s) does it connect with?

Grade(s): Which grades is this game appropriate for? Include content and trigger warnings here (inappropriate behavior, violence, sexual content, drug use, etc.).

Platform: PC, Windows, Mac, iPad, mobile, console, …

Cost: include cost for individuals, groups, institutions, etc. as relevant.

Time to Play: Approximately how long does it take to play through to the end? If there is no definite ending, say "open."

Teacher Time Investment: Approximately how much time will it take a teacher to become familiar enough with the game that they can use it effectively in class?

Stand-Alone: Is this game something the students will play without teacher involvement? An answer of "no" here means that this is a game that is part of a lesson rather than the lesson itself.

General Overview of Game

Provide short paragraph that describes the game. If applicable, include a list of websites, the game guide, or other resources where one can find out more about the game. Also include related resources such as: Scenarios, Suggested Group Activities and Projects (undetailed).

Curricular Ties (Official Curriculum)

What this game teaches. You can be fairly general here rather than connecting with formal curricula, but either one is OK.

Hardware and Software Specs and Requirements

What machines does it run on. If it is a web game, what is the required browser support.

Teaching and Learning Strategies

Ways to use the game. You can refer to the list of 101 Instructional Strategies, or list anything you have done. Be sure to note if the idea has been tried, and if so add a comment or two about how it went.

Organizing Structure and Content

What aspects of the game are most important here? Include any organizational or behavioral management notes that are appropriate. If they only apply in certain situations or with certain topics, note that too.

Online and Out of Class Teaching Strategies

Could this be used in an online environment? As part of flipped classroom exercise? Any strategies that are specific to using the game outside of the classroom should be noted here.

References

Include any articles written about the game, and especially any educational research that deals with this game. Remember to cite any articles you might have used to create the notes above.

12.11 Glossary

This glossary contains explanations and definitions for terms used in the book. Any term in the book that appears first in *italics* is defined here. Many of these terms have multiple definitions, but they are defined here to explain what they mean in this volume.

Abbreviations

The following is a list of abbreviations used in this book. They are here for quick reference. Their descriptions/definitions can be found in the glossary under the full term.

4PEG—4 pillars of educational games
AI—Artificial intelligence
BLT—Becker's lazy test
CoP—Community of practice

COTS—Commercial off the shelf
DGBL—Digital game-based learning
DGP—Digital game pedagogy
ELO—Educational learning objective
ESRB—Entertainment software rating board
FPS—First person shooter
G4L—Games for learning
ISD—Instructional systems design
LARP—Live action role play
LO—Learning objective
MMORPG—Massively multiplayer online role playing game
MMO—Shorter version of MMORPG
NPC—Non-playing character
PO—Primary objective
POV—Point of view
PvE—Player versus environment
PvP—Player versus player
RPG—Role-playing game
SME—Subject matter expert

4 Pillars of Educational Games (4PEG)

This is the analysis model that is the main focus of Chaps. 6 and 7. It includes a total of 20 items organized into four pillars:

- The game pillar.
- The educational content pillar.
- The teacher's support pillar.
- The overall balance pillar.

7 ± 2

A concept first described by George A. Miller (1956) that defines the practical limits on human working memory. He theorized that most of us are capable of dealing with approximately seven things simultaneously (plus or minus two). For example when presented with an image for a brief time and then asked to recall items in the image, people are typically able to recall about seven items.

Adaptive Agents

An adaptive agent is an application or part of a program that responds to its environment in one of four primary ways. These can appear in games as NPCs, guides to help or challenge the player, or changes in the environment itself. Adaptive agents can simply react to an event of signal, they might infer things from the player's behavior (reasoning), or actually change (i.e., learn).

Adventure Game

An adventure game is one where the player takes on the role of an in-game character (usually the protagonist). The story is usually driven by exploration, problem- and puzzle-solving.

Affordance

An affordance is a relationship between an environment or object and the player that affords the opportunity for the player to perform an action. For example, a game may allow players to do things they aren't supposed to (like break an object or push something off a cliff). A good game will respond in a way that teaches the player something.

Analog

Analog entities are continuous signals, from the songs on a vinyl record, to the pencil notes on a piece of paper. A game that exists outside of the computer, such as a board or card game is an analog game.

Analog Game

A game that exists outside of the computer, such as a board or card game is an analog game.

Artificial Intelligence (A.I.)

The core "engine" of the game that embodies the game's rules and conditions for winning, as well as how the characters within the game will interact with each other.

Artifact

An object being used for a specific purpose.

Attract Mode

This mode is the one that runs when the game is on but not in a state of active play. In arcades, this mode is the one always running when no-one is playing it. Some console games also have an attract mode that runs until the player restarts or continues the game.

Avatar

An avatar is a graphical representation of an individual. It can be a photo, animation, or other graphic that is meant to represent the user in a game or within some virtual space. In some online spaces like Second Life the avatar may appear to be three dimensional and can be controlled by the user. In other social spaces like Facebook, an avatar may simply be a .gif (image) that is associated with items published by that user.

Back Story

The story that underlies the game, and sets the stage for the main game goals.

Becker's Lazy Test (BLT)

Can a "lazy player" get through the game without learning anything? The BLT is one element of the four pillars of educational gaming, listed as part of the educational content pillar. Becker's lazy test focuses on how well the learning objectives are integrated into the game by determining whether it is possible to get through the game without paying attention to the learning goals of the game. If it *is*, then the game passes the test, which in turn means that the learning objectives are NOT well integrated.

Boss Challenges

These are challenges (often physical conflicts) with a major opponent and often mark the final challenge of a level or the entire game. Many games require players to achieve a certain level of achievement or score in order to earn the opportunity to enter a boss challenge.

Business Games (B-Games)

B-Games are a form of simulation for the purposes of teaching business. They can be digital or not.

Chunking

A concept first described by George A. Miller (1956) that relates to our capacity to combine individual items, ideas, etc. Into a single cluster which enables us to consider the collection as if it were a single entity. This enables us to consider more using less effort.

Close Playing

An adaptation of the idea of close reading for literature. In this case it involves paying attention to the minute details of a specific scene or interaction, including any dialog, imagery, and music.

Coincidental Learning (Magic Bullet)

Part of the Magic Bullet analysis tool. This category includes other things we can learn. These are not necessarily designed into the game, although sometimes designers may hope that players choose to take these up.

Commercial Off The Shelf (COTS) Games

These are games produced for commercial purposes and sold largely through commercial retail outlets. Some COTS games have been used quite successfully in learning situations, such as *Minecraft* and *Gone Home*, in which case they could be refereed to as games used in serious contexts, but they are still commercial games.

Community of Practice (CoP)

Groups of people who share a concern or passion (affinity group?) for something they do and learn how to do it better as they interact regularly.

Computer Game

A computer game is one that requires the computer in order to play it. In other words this is a game that can not be played without a computer. There are some games that only exist as computer games: *Tetris*, *Mario*, *Katamari Damacy*, while others are merely digital versions of traditional games, such as *Solitaire* and *chess*.

Computer Simulation

A computer simulation is a program or set of programs that implement a model.

Computer Mediated Games

Computer mediated games are those that have versions that can exist apart from the computer, such as *chess*, *solitaire*, or *Jeopardy!*. These games are effectively simulations of analog (i.e., non-digital) games.

Conceptual Coherence

Conceptual coherence is a property of an object or system that is held together by a unified and coordinated set of design ideas.

Confirmative Evaluation

The primary goal of confirmative evaluation is to confirm that the intervention is still meeting the needs it was designed to address. This sort of evaluation takes place after the intervention has been deployed and can take place weeks, months, and even years later. This sort of evaluation is not performed as frequently as formative and summative evaluation, partly because it can be challenging to contact participants. However, knowing whether or not a learning intervention has had a lasting effect is an important aspect of evaluating learning.

Conscious Gaming

It is an approach to gaming where players play with an awareness of what they are doing (contrast with targeted gaming). Conscious gaming is at odds with being in a state of flow while playing, but can be very useful in game-based learning.

Cosplay

This is a form of live action role play (LARP) that involves dressing up in costume. It usually involves specific characters from fiction, comics, television, and games.

Cut Scene

These are non-playable parts of the game where part of the back-story or game narrative is revealed, typically in small portions lasting anywhere from several seconds to a few minutes. They can be in the same style and quality as the game itself, but they can also appear as movie quality clips.

Decorative Media Principle

The decorative media principle is the idea that we can increase the effectiveness of a learning intervention by creating a visually pleasing background or other decorations for a worksheet, website, etc. that is thematically connected with the instruction or other purpose. For example, in the work the author does with the "Ducks in the Classroom" project, vocabulary and word games are created on a pleasing background—possibly a nest, words enclosed in images of eggs, duck footprints, etc. The principle, although unproven is that the decoration helps to increase interest and may also increase the conceptual coherence of the learning object (Becker, 2012).

Decorative Media Trap

Coming out of the concept of the Decorative Media Principle, the "trap" is the mistaken belief that a pleasing, pleasant, or impressive appearance implies that the artifact is well designed and will be effective. Many educational games fall into this trap. The game may look nice, but the gameplay is lacking and the learning objectives are poorly implemented. From the design perspective, people fall into this trap when they believe that appearances are either sufficient or, even worse, that they can compensate for a poor or mediocre design.

Demo (Demonstration)

Demo is short for demonstration. Game demos are performed to show the features of a game.

Differentiated Instruction

Differentiated instruction involves creating multiple paths through the learning so that all students, including those of different abilities, interest, or learning needs have a chance to absorb, use, develop, and present what they are learning as a part of the learning process. It allows students to take greater responsibility and ownership for their own learning, and provides opportunities for peer teaching and cooperative learning.

Digital

Digital things are those that are represented in one way or another as binary digits. This includes everything from the text of this book as it was entered on the author's computer, to an image stored as a jpeg, a song stored as an mp3 file, or a 3D movie stored on a DVD. All digital entities are, by necessity, discrete.

Digital Divide

This refers to the gap between those who have access to technology, including high-speed Internet and mobile devices and those who don't. This can apply to individuals in the same geographic locations, in which case the difference is primarily one of relative wealth, but it sometimes refers to entire geographic locations. In the latter case the difference is still often one of rich versus poor.

Digital Game

A digital game is a game that exists on a computer, game console, or mobile device.

Digital Game-Based Learning (DGBL)

Learning of some knowledge, skills, attitudes that happens with the deliberate use of digital games. This could involve learning by playing games, but it can also involve learning through building games. DGBL is about learning with games.

Specifically, DGBL is the theory of how learning happens with the use of (primarily digital) games. Game-based learning draws on a variety of other learning theories to explain how people learn with games.

Digital Game Pedagogy (DGP)

As pedagogy is about the study and theory of teaching, digital game pedagogy is about the study and theory of teaching with games. It is a term not commonly used, but it is meant to highlight the distinction between *learning from* games and *teaching with* games. The two terms are closely related but are effectively opposite sides of the same coin—one from the perspective of the learner and the other from the perspective of the teacher.

Discretionary Components (Magic Bullet)

Part of the Magic Bullet analysis tool. This is part of the educational layer added on top of the four learning categories. Discretionary learning includes all those portions that don't fit into either operational learning or educational learning. These can add value, but it is important to avoid falling into the decorative media trap.

Education

Education is a subset of learning that has an implied value. Education implies deliberate facilitation of valued learning which occurs over and above what is natural, and implies some persuasion (possibly even coercion) that is enacted on the recipient of this education. Now this is not meant to imply any negative connotations necessarily, as many individuals willingly accept and embrace many forms of education. This description is meant to distinguish between learning as a naturally occurring phenomenon and can be done to oneself, and education, which is deliberate, and can be done to oneself or to others.

Educational Learning Objective (ELO)

The term is used here to distinguish the learning objectives we are specifically interested in for our purposes from any other learning objectives that might be part of a game.

Educational Component (Magic Bullet)

Part of the Magic Bullet analysis tool. This is part of the educational layer added on top of the four learning categories. This is the piece that has the greatest relevance to the classroom and the relative proportion of this to the other categories will help predict the game's potential value as a educational tool.

Edutainment

Edutainment is (erroneously) used by many educators to refer to any form of educational computer game. It is sometimes used more broadly to refer to all popular media that has an educational component. Edutainment is the term used by game developers to refer to poorly designed educational software. The term first became known during the 1980s when the use of computer games for education first became popular.

End Game

This refers to the part of the game that involves the final level or challenge of the game. It is much like the final chapter of a story. See also Win State and End State.

End State

The conditions that exist at the end of the game. The term can also apply to the conditions at the end of a level or round. See also Win State and End Game.

Evaluator Role

This role is about evaluating the game outcomes and students' learning experiences. This may simply be a matter of recording data collected by the game or during play, but it may also involve helping the students to reflect on their learning and put it into a meaningful real life context.

External Learning (Magic Bullet)

Part of the Magic Bullet analysis tool. This category includes learning that happens outside of the game: in fan sites, and other social venues. This category also includes "cheats."

Fan Fiction

Fan fiction is the creation of stories using settings and characters from existing fiction, film, or television. It requires a fairly thorough understanding of the world in which the original stories took place as well as an understanding of the existing characters.

First Person Shooter (FPS)

A game where the primary game mechanic is one of shooting (a gun or other weapon). The first person perspective is one that is played as if the player were the main character. In other words, the player sees the game as the main character would.

Formative Evaluation

Robert Stakes has offered perhaps the simplest explanation: "When the cook tastes the soup, that's formative. When the guests taste the soup, that's summative" (Scriven, 1991, p. 19). Formative evaluation normally takes place while the intervention is still in development, before it has been deployed. The evaluators are often the developers and other stakeholders, but do not normally include the target audience, although pilot studies may be included as formative evaluation.

Freemuim

A game or other application that offers the initial content for free and then allows users to purchase additional content. For example, a freemium game may offer the first level for free and then sell additional levels.

Game

A game:

- Is interactive
- Has rules

- Has one or more goals
- Has a quantifiable measure of progress(or success)
- Has a recognizable ending (usually)

Games for Learning (G4L)

Includes educational games—i.e., those designed specifically for use in the classroom, but also a broader category, which includes games that are intended for learning but may be used in informal settings.

Game Objective

Every game must have a clearly defined purpose for being, in other words the objective or message. What is the game about? Why are the players playing? What is the take-away?

Game Mechanics

Game mechanics are the mechanisms by which the player achieves the goals of the game. They include the actions that the player can perform like: turn-taking, shooting, collecting, aiming, moving, choosing, and buying. Jesse Schell, game designer and author of The Art of Game Design (Schell, 2008) describes game mechanics as "the interactions and relationships that remain when all of the aesthetics, technology, and story are stripped away."

Gamification

Gamification is the use of game design elements in non-game contexts. It is not necessarily about learning and can be used in any context. Examples include companies that offer points, reward systems, badges, and other incentive-based techniques, usually with the intent of increasing brand association and loyalty.

H.U.D. Heads Up Display

Commonly used to refer to the display board that contains the game's vital information such as score, the player's statistics (health, assets, etc.), current game conditions, and so on. This may also include a map and other information.

Heuristic Analysis

Heuristic analysis uses part experience and often a variety of approaches, either simultaneously or sequentially in order to analyze a problem.

Humanism

Humanism is a paradigm of learning that centers on self-actualization and takes a more holistic approach. Its focus is on the human potential for growth. It rejects the notion that behavior is predetermined (as behaviorists do) or that it is determined primarily by environment or the subconscious. It assumes that people are inherently good and will strive to better themselves and their environment.

Individual Education Program/Plan

A federally mandated plan that defines the individual educational objectives for a child that has been found to have a disability. Both the USA and Canada have such a mandate.

Instructional Design

Instructional design is the process of creating instruction through the analysis of learning needs and the systematic development of learning materials.

Instructional Ethology

Instructional Ethology is the study of the externally observable "teaching" behavior of a digital game. It is adapted from the approaches used to study animal behavior, and examines games from four perspectives:

- The game's structure
- Its function or support
- The interaction
- The game's similarity to other games, which in turn speaks to notions of genre (classification)

In Instructional Ethology, the main guiding question is "How does this game support the learning the people can or must do in order to succeed in the game?" There are also perspectives of Software Ethology, and Game Ethology (in a more general sense). One could also study any specific aspect of a game from an ethological perspective, so for example, one could study a game's ethical ethology.

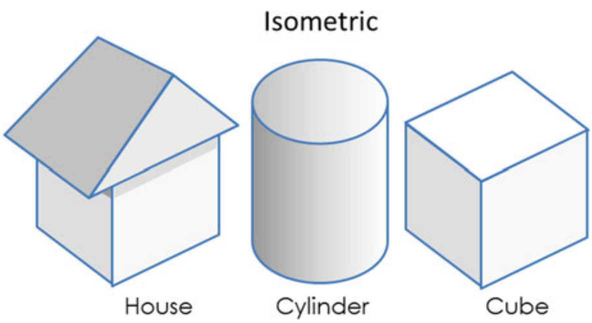
Instructional Strategy

The instructional strategy is the plan for what will happen during the course or lesson. It includes such approaches as question and answers, play-acting, group discussion, and so on.

Instructional System Design (ISD)

An approach to the design of instruction that attempts to be systematic. Design and development typically follow a prescribed formula with respect to project management, but also often with respect to the format that the instructional intervention will take and even its delivery.

Isometric Perspective



A viewpoint in games that is a blend between top-down and side or front views. It gives the appearance of looking at the game space in three dimensions from above.

Live Action Role Playing (LARP)

This is a form of role-play that is typically played in public spaces, often without the knowledge of the general public. It often involves some sort of fantasy, such as playing as vampires or elves. It may or may not involve costumes. It is a more popular pastime in Europe than in North America.

Learning

Learning is a natural condition of being human. It always involves some sort of change: change in what we remember, our skills, attitudes, or behaviors. Learning is neither positive nor negative. We can learn things that are useful or useless, life-saving or dangerous, helpful or hurtful. In short, learning has no associated implications of moral, ethical or other value.

Learning Activity

An action the learner can be directed to do that can be assessed in some way even if it is only to note it as complete.

Learning Object

The IEEE Learning Object Standards committee defines as “any entity, digital or non-digital, that may be used for learning, education, or training.” (IEEE, 2002, p. 3).

Learning Theory

Learning theories consider how the existing conditions of a person and their environment interact with the psychological and physiological functioning of the human mind and body to bring about a change in that person’s worldview, behavior, and/or skills.

Lesson Plan

Lesson plans are guides that we use to structure the activities supporting particular topic(s) or objectives in class. The point of a lesson plan template is to provide a guide that can be used when planning lessons.

Level of Detail/Point of View (L.O.D./P.O.V.)

Games typically allow players to change the level of detail by zooming in or out. It may also be possible to change the point of view so players can see what is behind them or look at objects from a different angle.

Levels

Somewhat similar to chapters in a book, levels are parts of a game that contain one or more complete challenges. Subsequent levels typically build upon previous ones by adding new or more difficult challenges, new abilities, opening up new areas to explore or adding new opponents. Level progression goes from simple to complex or easy to hard.

Likert Scale

A Likert scale is a widely used psychometric scale often used in surveys. Questions that use it are typically worded as statements to which the response is a measure of the degree to which the respondent agrees with the statement.

Loot

Loot is another name for the items that players can collect in a game. Items can consist of in-game currency, spells, equipment, or weapons are often used directly to help the player, and can sometimes be used to trade for other things.

Machinima

Machinima is the creation of videos using games. They are effectively plays that take place inside a video game rather than on a stage.

Magic Circle

The magic circle is a conceptual space where things are permitted that cannot (or should not) happen in real life Even though games exist in this magic circle apart from reality, we can learn things from games that we can apply to real life. Children of almost any age seem to understand that this special realm exists, and most of us probably remember playing complaining that someone in the group "wasn't playing right"—there are always rules to game-style play, even if they aren't explicit.

Mastery Learning

Mastery learning is an approach where learners are helped to master a particular unit, concept, or task before moving on to the next one. What constitutes 'mastery' is determined ahead of time and can be measured.

Mental Models

This is an individual internal model or concept of some principle, concept, reality, or situation. It is thought to be one way that we have to organize ideas. See also Schemata

Mimesis

Mimesis, a term from ancient Greece means imitation or representation, as opposed to diegesis narration or report. Memesis can include behaviors such as: pantomime, imitation, gesturing, sharing attention, ritualized behaviors, and many games (Donald, 2001). Some believe that mimetic skill constitutes the missing link between ape and human culture. In contrast to episodic skill "mimetic skill rests on the ability to produce conscious, self-initiated, representational acts that are intentional but not linguistic" (Donald, 2001, p. 168).

Mini-Game

A mini-game is a distinct game (according to the definition of a game) inside a larger game. They are typically short games and are often puzzles. They can be used to control progress through the containing game (i.e., to level up) or they can be intended as simple diversions.

Mise-en-scène

Mise-en-scène means "setting the stage" and in our context refers to those aspects of the lesson design that include such things as the vocabulary we use, the preamble leading up to the game, as well as the real-life physical environment that the students will be in when they play the game. It also includes such aspects as the timing of various aspects of the lesson.

Model

A representation and set of transformational rules which can be used to predict the behavior and relationships between the set of entities comprising the system (Franta, 1977).

A precise internal representation of a system that includes its variables, behaviors, and their interrelationships. The way we describe the model and the kinds of values and relationships we include will determine what we can do with this model, so it is important to know where we are going with this model right from the start. A model can be used to describe a concept, an entity, or a process. In computer simulation, our models often have something to do with a process.

Narrative

The ongoing story as it does or can unfold. It is what comes after the back-story, often adding to it.

Newsgame

A newsgame is a game based on news events. It is usually a serious game that seeks to provide commentary or to be thought-provoking or even to change attitudes.

Non-playable Character (NPC)

A character that appears in the game with which you may or may not be able to interact but whose behavior is determined by the game's design. These characters are not controlled by the player.

Objective (Learning)

A learning objective can be thought of as the teacher's intention for a lesson, course, or other intervention. This is the educational goal from the teacher's perspective. It is the other side of the coin from a learning outcome, but the two are closely related.

On Rails

A game that is on rails is one where the player has no options other than to follow along the path that has been laid out. There is no room for exploration that is not directly connected to the goal, and the player can not progress until they achieve the objective that has been given to them. The next objective is normally not presented until the current one has been met.

Operational Component (Magic Bullet)

Part of the Magic Bullet analysis tool. This is part of the educational layer added on top of the four learning categories. Operational learning in a game has to do with learning to work the game controls and some of the basic mechanics (such as how to make pick things up, open doors, navigate, etc.) This is part of the necessary overhead involved in using a game for learning. The proportion of this sort of learning to the educational component has a bearing on the potential usefulness of a game.

Outcome (Game)

The outcome is the final state of the game. This is a quantifiable (i.e., obvious) state: it will be clear whether or not the player achieved the stated goal (Salen & Zimmerman, 2004, p. 96). The win state always depends on the valorization of the game. MMOs and other persistent-world games tend not to have an end outcome, but will almost always have missions, quests, or mini-games that do have clear and definite outcomes (Juul, 2005).

Outcome (Learning)

A learning outcome can be thought of as a description of what the learner should know or be able to do as a result of a lesson, course, or other intervention. This is the educational goal from the learner's perspective. It is the other side of the coin from a learning objective, but the two are closely related.

Perspective

This is the viewpoint that the player has when playing the game. There are five major perspectives:

- First-Person: the play sees what the main character sees.
- Third-Person: The player see what the character sees but also gets to see the character—almost as if you were the character's shadow ("over-the-shoulder").
- Top-Down: This is a view from above (bird's-eye view).
- Isometric: A variation of the Top-Down view but one that allows the player to see partially from the side as well (tilted top-view; slightly to the side).
- Side-View (two-dimensional horizontal view).

Platform Game

A platform game (a.k.a. platformer) is a game, usually in two dimensions where the game space consists of various platforms that have a variety of obstacles, where the player controls an avatar that must navigate by jumping from platform to platform while avoiding the obstacles.

Playmaker

One of the teacher roles defined by Hanghøj where teacher communicates the tasks, roles, goals, and dynamics of the game, its narrative or other scenario as seen from the perspective of the player (Hanghøj, 2013).

Play-Testing

This is a form of testing that involves having people play your game before it is officially released. It may be done in controlled environments, often with recording devices so the players reactions can be analyzed in detail. It is also sometimes done in more uncontrolled situations, such as releasing a "beta-version" of a game and allowing a limited number of people to play it in order to collect data and uncover potential bugs.

Player versus Environment (PvE)

Player versus environment is a mode of play in which players compete against the game's artificial intelligence (AI), rather than other players.

Player versus Player (PvP)

Player versus player is a mode of play in which players compete against other players, rather than the game's artificial intelligence (AI).

Point-and-Click

This is a genre of game that does not have sophisticated controls. On a mobile device they usually are controlled by the player's finger. On a PC they can often be played using only the mouse.

Predictive Evaluation

Predictive evaluation is not particularly common in formal education. It is conducted before the intervention is developed—sometimes even before it has been designed. It's purpose is to evaluate the potential suitability or likely effectiveness of an intervention. All that can be determined at this stage is the potential usefulness, but as educational software and other digital instructional materials become more complex, the amount of institutional and human resources needed to make optimal use of these materials grows as well. The ability to evaluate software *before* it gets adopted could be very beneficial.

Primary Objective (PO)

The primary objective is the main goal of the game. It is the one that is directly tied to the victory condition. Once the primary objective has been met, the game is won. Many games have multiple intermediate objectives that must be achieved before one can have a chance at meeting the primary one. For example, the primary objective in most of the Super Mario Brothers games are to rescue Princess Peach, which involves fighting and beating Bowser. However, each level and each individual course has its own objectives. Some games, such as those in the Animal Crossing series have no primary objective—only intermediate ones, and so the game has no clear end.

Respawn

This is a term often used to describe the process of re-creating an avatar when it has been killed. It may require the use of saved resources (currency, magic, health, etc.) and may also involve some loss of status or power on the part of the character.

Role Playing Game (RPG)

A game where the player takes on the role of a character within the game.

Sandbox Mode

Practice mode, where scores do not count towards a win. Some games contain only a sandbox mode as their primary mode of gameplay, such as the SIMs games.

Save Point

Many games allow players to save their progress at various points in the game. These can then be loaded at a later point in time so that players can pick up where they left off. Some games will only store a single save point and others allow you to save the game at various times, allowing to restart the game from various points.

Scaffolding

Instructional scaffolding is the act of putting into place strategies and methods to support the student's learning.

Scrum

An agile approach to completing a design or development project. The idea is to collect input from all stakeholders into a list called the "Backlog." In each time period, known as a "Sprint" (which could be 1 month), the development team selects as many of the top priority features from the Backlog as it can develop in that time. After the time is up, the results are presented to the stakeholders again, who provide feedback. They may at that time may reorganize or even modify the Backlog. This means that new questions, tasks, or other elements can be added after each sprint. Then the team selects a new set. In order to make sure things keep progressing, each feature is associated with a time-line or time limit (and other required resources) (DeGrace & Stahl, 1990).

Serious Game

A game that has been designed to have a purpose other than or in addition to entertainment. While some entertainment games are often used as educational games, such as Sid Meyer's *Civilization*, it is the designed intent that classifies a game as serious. Games like *Civilization* is a game used for serious purposes.

Short Form Game

A game having only a few minutes of actual playing time and often with limited goals. These are often a casual games, needing little commitment from the player and are playable in small snippets of spare time.

Side-Scroller

A game played in two dimensions where the player can move up, down or sideways, but not forwards or backwards. Normally, the up and down movement is somewhat restricted.

Simulation

A computer programmed implementation of an abstract model. Sivasailam Thiagarajan, the noted performance training designer said that a simulation is "a representation of the features and behaviors of one system through the use of another" (Thiagarajan, 1998, p. 35).

Simulation Game

A game that exposes the simulation that underlies it as a component of play. *Civilization* is a simulation game because the object is to manipulate the simulation parameters directly, rather than by using indirect mechanics. The Tycoon games (EG. *Roller Coaster Tycoon*) are also popular simulation games.

Simulation Model

A representation, either mathematical, graphical, verbal, or otherwise, of some system of interest, upon which a simulation will be based.

Story Mode

That part of the game where gameplay is "on-rails," meaning that the player has little to no control over where they go and what tasks they attempt. They are given specific tasks which must be completed, often to a predetermined minimum level of competence in order to progress. This device is often used to ensure that the player is exposed to specific story elements, and often makes use of cut-scenes.

Structured Analysis

This is a concept originally from engineering. It is used in here to describe a form of analsys that follows a specifc, pre-defined set of steps. This allows other similar analyses performed by someone else or even on a different game to be compared against each other element by element.

Subject Matter Expert (SME)

This is the person(s) who has authoritative knowledge about a particular subject or field. When a teacher takes on this role, they act as consultants for players in matters having to do specifically with the subject matter covered in the game.

Subsumption Theory

This is David Ausubel's theory of how people learn large amounts of material. The basic idea is that the new learning becomes connected with and part of (subsumed) existing knowledge.

Summative Evaluation

Robert Stakes has offered perhaps the simplest explanation: "When the cook tastes the soup, that's formative. When the guests taste the soup, that's summative" (Scriven, 1991, p. 19).

Summative evaluation typically takes place after the intervention has been completed. It may occur before or after deployment. It often includes the target audience or other participants who are similar to the target audience.

Targeted Gaming

It is an approach to gaming where players play with specific goals in mind that may or may not be goals inherent in the game (contrast with conscious gaming).

Teacher Roles

The various behaviors that teachers take on in relation to the situations they are in and the interactions they enact with their students (Hanghøj, 2013).

Things We Can Learn (Magic Bullet)

Part of the Magic Bullet analysis tool. This is a category of learning that includes things deliberately designed by those who created the game.

Things We Must Learn (Magic Bullet)

Part of the Magic Bullet analysis tool. This category of learning will almost always be a subset of the first category, and includes only those items that are necessary in order to win or get to the end.

Time: actual and game-time

The passage of time in games may change between actual real-world time and accelerated, skipped, or even slowed game-time. Often the passage of time during play is reflective of real time, but like in movies, a change of scene or location can also coincide with a change of game time.

Trailers

These are the game advertisements, often containing cinematic quality clips, screenshots of actual gameplay, and other dramatic devices to give potential players an idea of what the game is like.

Toy

For the purposes of this volume, a toy is distinguished from a game in that it lacks rules for how to play with it. A toy also lacks inherent goals or objectives and so there can be no way to measure progress.

Tutorial Mode

Often occurring at the beginning of the game but in some games it can also be triggered at the start of a new level or challenge or in response to poor player performance. In this mode the player often receives direct guidance, visual, verbal, and otherwise from the game. This mode's purpose is to help the player acquire sufficient knowledge and skill to mange the basic gameplay.

Twitch Games

These involve fast responses such as making your character jump, punch, or shoot.

Unit Plan

A unit plan is a way of organizing the lessons contained within the unit to help ensure that the unit is complete. The unit plan is an overview of a collection of related lesson plans, and the main goal of the unit plan is to create continuity and coherence between the individual lessons of a unit.

Universal Design for Learning

Universal Design for Learning (UDL) is a research-based framework for designing curricula. It includes the design of educational goals, methods, materials, and assessments that enable all individuals to gain knowledge, skills, and enthusiasm for learning. This is accomplished by simultaneously providing rich supports for learning and reducing barriers to the curriculum, while maintaining high achievement standards for all students (Rose, Meyer, & Hitchcock, 2005).

Valorization

Different values are assigned to different outcomes within the game; some are winning outcomes (better) and some are loosing outcomes (worse). Often the more highly valued outcomes are more difficult to achieve than the negatively valued outcomes (Juul, 2005). The values placed on various outcomes as well as the values associated with various choices made during gameplay are determined by the game designers, and may or may not coincide with societal norms, or the value-set personally espoused by the designer.

Walk-through

A written, graphic or video description of gameplay. A complete walk-through starts at the beginning of the game and goes all the way through to the final end state.

Webquest

A webquest is a form of lesson where students perform research on the web into a given topic. It should go beyond a simple collection and presentation of material found on the web. It involves analysis, synthesis, and distillation of what is found as well as formatting it into something that can be shared with others.

Wicked Problem

A Wicked Problem, as defined by Rittel & Webber (1973) as a class of problems that include a social context which are very complex and hard to solve. It includes ten properties as defined below:

- There is no definitive formulation of a Wicked Problem.
- Wicked Problems have no stopping rule.
- Solutions are not True/False but Good/Bad.
- There is no ultimate test of a solution to a Wicked Problem.
- Each solution is a one shot operation.
- Wicked Problems do not have enumerable (exhaustively describable) solutions.
- Each problem is unique.
- Each problem is a symptom of another problem.
- There are a number of different stakeholders interested in how it is solved.
- The planner has no right to be wrong.

Win State

The conditions necessary in order to win the game. See also End State

12.12 Games and Other Software

This list includes all of the games and other software applications mentioned in the book. This list includes URLs when possible and other info when appropriate, such as a brief synopsis of the game, its genre, what subjects it might be good for, links to the game, etc.
Some games are dated, but by seeing these games mapped onto curricula one can use the same approach in other games.

Add 'Em Up
(2004) [Other] Blue Bug Games (Developer), Blue Bug Games (Publisher), [Browser], Game Site: http://www.addictinggames.com/puzzle-games/addemup.jsp.

Rating: E	Genre: Puzzle, Math	Perspective: Other.	
Cost: Free (online)	Subject: Math	Grade: 2+	Time to Play: 10 min+.

Synopsis: Played on a grid of number tiles, the goal is to clear the board. There is a queue of numbers on one side. Select adjacent tiles on the board that total the number in the queue. Since we are only dealing with single digits if the sum is >9, then only the last digit matters.

Angry Birds
(2009) [3rd-Person Perspective, Side-Scrolling] Rovio Mobile Ltd. (Developer), Clickgamer Technologies Ltd. (Publisher), [Available on Most Platforms], Game Site: https://www.angrybirds.com/.

Rating: E	Genre: Strategy	Perspective: 3rd-Person Perspective, Side-Scrolling.
Cost: Free+	Subject: Physics	Time to Play: 15 min+.

Synopsis: Green pigs have stolen your eggs and you are now an angry bird who wants them back. This is done by using a catapult to launch birds at the structures in which the pigs are hiding in order to break them. The physics used to project the pigs to their targets are quite accurate and can be used to explore principles of motion and Newton's Laws of Motion.

Animal Crossing A New Leaf

(2013) Nintendo (Designer) [3rd Person] Nintendo EAD (Developer), Nintendo of America, Inc., (Publisher), [Nintendo DS], Game Site: http://www.mobygames.com/game/3ds/animal-crossing-new-leaf.

AKA: ACNL	Rating: E	Genre: RPG	Perspective: 3rd Person.
Cost: $40 (1915)	Audience: All	Time to Play: 15 min+.	

Synopsis: Animal Crossing: New Leaf is the 3D edition of the Animal Crossing series. Just like in the previous version, players assume the role of a new resident in a town populated and run by animals. Players can interact with townsfolk, write letters, send presents, dig for fossils, fish, and perform other activities. The game also runs in real time and utilizes the Nintendo DS' internal clock and calendar to keep track of special events that occur on certain dates. This edition includes an expanded village with new fruits, a tropical island, and the ability to swim and dive.

Assassin's Creed II

(2009) [1st, 3rd Person] Ubisoft Divertissements Inc. (Developer), Ubisoft (Publisher), [Macintosh, PlayStation 3, Windows, Xbox 360], Game Site: http://assassinscreed.uk.ubi.com/interstitial.htm.

Rating: M	Genre: Fantasy, Stealth	Perspective: 1st, 3rd Person.
Subject: History	Grade: 11+.	

Synopsis: This is the second in the Assassin's Creed series. In this game you play Desmond Miles who is a descendant of an ancient order of assassins. This time Desmond escapes his captors (Templars) with the help of one of the scientists. They team up with a group of allies who use a new version of the Animus to send Desmond to relive the life of a fifteenth century Italian named Ezio Auditore di Firenze.

Ayiti: The Cost of Life

(2008) A. U. Nick Fortugno, Jonah Warren (Designer) UNICEF (Publisher), [pc], Game Site: https://ayiti.globalkids.org/game/.

AKA: Ayiti	Genre: Serious Game.	
Cost: Free	Subject: Social Studies, International Affairs	Grade: 9+.

Synopsis: What is it like to live in poverty, struggling every day to stay healthy, keep out of debt, and get educated? Find out now in this challenging role playing game created by the High School students in Global Kids with the game developers at Gamelab, in which you take responsibility for a family of five in rural Haiti.

Bejeweled
(2000) [Other] PopCap Games, Inc., (Developer), [Available on most Platforms], Game Site: http://www.popcap.com/gamepopup.php?theGame=diamondmine.

Rating: E	Genre: Puzzle	Perspective: Other.
Cost: Free+	Time to Play: 10 min+.	

Synopsis: The object of the game is to score as many points as possible by swapping adjacent gems to create sets, either horizontal or vertical, of three or more identical gems.

Black & White
(2001) P. Molyneux (Designer) [3rd Person] Lionhead Studios (Developer), Electronic Arts (Publisher), [PC], Game Site: http://www.lionhead.com/bw/.

Rating: T	Genre: Role-Playing (RPG), Simulation, Strategy, Managerial, Real-Time	Perspective: 3rd Person.
Subject: Ethics, Morality.		

Synopsis: Black & White is a "god" game, where one plays a fledgling deity, called upon by people in need. It is a game about exploring ethics and morals where the player can influence the behavior of the game and can move items or affect the weather, but where the player does not represent a specific character within the game. Instead, the player is allowed to choose one of several animals to look after that is affected both behaviorally and developmentally by the choices the player makes. In this game the "instructors" come in the form of two spiritual advisers: one good and one bad.

Blast Off!
(2012) United States Department of Agriculture (Publisher), [Browser (Flash 7)], Game Site: http://www.fns.usda.gov/multimedia/Games/Blastoff/BlastOff_Game.html.

Genre: Educational.			
Cost: Free	Subject: Health	Grade: G1–4	Time to Play: 20 min.

Synopsis: A game that uses fuel for a rocket as a metaphor for balanced nutrition. Players must fill four fuel tanks, where each one uses food from the four major food groups as fuel.

The Blood Typing Game
(2011) L. Göransson, M. Labedzki and K. Svanholm (Designers), [Other] Nobel Media AB., (Publisher), [Browser (Flash 10)], Game Site: http://www.nobelprize.org/educational/medicine/bloodtypinggame/.

Rating: E	Genre: Educational	Perspective: Other.
Cost: Free	Subject: Science	Time to Play: Quick game 15 min, Mission based game 20 min.

Synopsis: This game is about human blood types, blood typing and blood transfusions. You try to save patients who need blood transfusions. You determine what blood type these patients belong to so you can give them transfusions without injuring them further.

Chicktionary: Farm Fresh Goodness
(2003) [Other] Blockdot, Inc., (Developer), Kewlbox (Publisher), [Browser (flash), Mobile], Game Site: http://kewlbox.com/games/gamedetail.aspx?gameid=117.

AKA: Chicktionary, Fowl Words	Rating: E	Genre: Educational, Strategy	Perspective: Other.
Subject: Vocabulary, Spelling	Grade: 2+	Time to Play: 10–15 min.	

Synopsis: This is a word scramble game where you are given seven letters (each represented by a hen) and try to make as many words using three or more of those letters as possible. There is a board above the hens that shows you how many words are possible along with their length and that keeps track of each word as you complete it.

Civilization IV
(2005) Meier, S. (Designer)[Isometric] Firaxis (Developer), 2K Games, (Publisher), [Windows], Game Site: http://www.2kgames.com/civ4/home.htm.

AKA: CivIV	Rating: T	Genre: Isometric Strategy, Managerial	Perspective: Isometric.
Subject: History	Grade: 10+	Time to Play: 2 h+.	

Synopsis: Sid Meier's Civilization IV is a turn-based game where the objective is to rule the planet. Players control one of 15 Civilizations (Aztecs, Egyptians, Russians, etc.). Each Civilization has its own particular strengths and weaknesses—some are more scientific, for example, while others have stronger cultural or military attributes. Players start with a single village in the Stone Age and must advance from there by exploring, founding cities, researching, exploiting natural resources and eventually trading or making war with neighboring civilizations.

Diabetic Dog Game
(2009) Nobel Media AB., (Publisher), [Browser (Flash 6)], Game Site: http://www.nobelprize.org/educational/medicine/insulin/game/insulin.html.

Rating: E	Genre: Educational.		
Cost: Free	Subject: Science, Biology, Health	Grade: 10+	Time to Play: 10–15 min.

Synopsis: In this game your dog has type-1 diabetes. A diabetic dog does not produce or properly use insulin and therefore has to get it through injections. Your mission is to take care of your dog and try to avoid letting him/her reach too high or too low levels of blood sugar—the more successful you are the more money you will get for which you can buy food and upgrade your dog's food bowl or doghouse!

DNA—The Double Helix Game
(2003) C. Åstrand (Designer) Nobel Media AB., (Publisher), [Browser (Flash 6)], Game Site: http://www.nobelprize.org/educational/medicine/dna_double_helix/.

Rating: E	Genre: Educational.		
Cost: Free	Subject: Science, Biology, Genetics	Grade: 10+	Time to Play: 10 min.

Synopsis: In this game your job is to first make exact copies of a double-stranded DNA molecule by correctly matching base pairs to each strand, and to then determine which organism the DNA belongs to.

Dora At The Dentist
(2013) [3rd Person] unknown (Publisher), [Browser (flash)], Game Site: http://mydentistgames.com/all-dentist-games/dora-at-dentist.

Rating: E	Genre: Educational	Perspective: 3rd Person.
Subject: Health	Grade: K-4	Time to Play: 15 min.

Synopsis: Dora takes a trip to the dentist (played by you) who must fix her teeth using a variety of techniques and equipment.

DragonBox Algebra 5+
(2012) WeWantToKnow AS (Publisher), [mobile, windows, mac], Game Site: http://dragonbox.com/homehttp://wewanttoknow.com/us/

Rating: 5+	Genre: Educational	
Cost: $7.49 in 2016	Audience: elementary	
Subject: Math	Grade: K-3	Time to Play: 30 min.

Synopsis: A math game that teaches young children about how to solve linear equations.

The Elder Scrolls IV: Oblivion
(2006) [1st, 3rd Person] Bethesda Game Studios (Developer), 2K Games, Inc., Bethesda Softworks LLC, (Publisher), [PlayStation 3, Windows, Xbox 360], Game Site: http://www.elderscrolls.com/games/oblivion_overview.htm.

AKA: Oblivion	Rating: T	Genre: Action, Role-Playing (RPG), Fantasy	Perspective: 1st, 3rd Person.

Synopsis: A shadow has been cast over the imperial province of Cyrodiil. The emperor has been assassinated by unknown forces. The gates to Oblivion have been opened and hellish Daedra pour out to ravage the land. At the center of it all? You. A doomed prisoner set free by chance. Will you use your second chance at life to save Cyrodiil from a terrible fate, or answer the call of another destiny? In this game, you are sent fourth to try and find the last remaining heir to the throne who is hidden because he is illegitimate, yet still possesses the necessary blood to restore order to the land. While this is the main story, the game is incredibly open in that there are many villages, all with quests that need not relate to the primary goals.

The Elder Scrolls V: Skyrim
(2011) [1st, 3rd Person] Bethesda Game Studios (Developer), 2K Games, Inc., Bethesda Softworks LLC, (Publisher), [PlayStation 3, Windows, Xbox 360], Game Site: http://www.elderscrolls.com/skyrim/.

AKA: Skyrim	Rating: M	Genre: Action, Role-Playing (RPG), Fantasy	Perspective: 1st, 3rd Person.

Synopsis: Dragons, which were thought extinct, return to the world. This comes at a time of strife for the province of Skyrim as the rebellious storm cloaks are in conflict with the previously reigning imperials over Skyrim. The imperials were recently defeated by the elves and in the contempt they hold for humans are attempting to "civilize" the lands, banning the god Talos, who was an ascended human, and a son of Skyrim no less. The hero is a dragonborn, able to use the power of "the voice" to find out why the dragons are returning and defeat them. In the game, your character can choose sides in the imperials/stormcloaks conflict which is central to the setting but not really the main story of the game. As with Oblivion, there are many little villages with their own worries which often don't relate to either of the other objectives.

FIFA Soccer 2005
(2004) Electronic Arts Inc. (Designer) [3rd Person] Electronic Arts Canada (Developer), Electronic Arts Inc., (Publisher), [All], Game Site: http://www.ea.com/ca/fifa.

Rating: E	Genre: Sports	Perspective: 3rd Person.

Subject: Kinestheology, Language Learning.

Synopsis: A game where you can play soccer (football). It allows the user to interrupt a simulation and join in the action. Create yourself as player and sign up with your favorite team.

Fast Car: Travelling Safely around the World
(2010) [3dr Person] I. Laskshya Digital (Developer), UNESCO (Publisher), [PC], Game Site: http://www.unesco.org/new/en/communication-and-information/crosscutting-priorities/hiv-and-aids/fast-car-travelling-safely-around-the-world/.

AKA: Fast Car	Rating: T	Genre: Educational	Perspective: 3rd Person.
Audience: -. y	Subject: Health, HIV AIDS.		

Synopsis: A 2D driving game where you get to drive around roads and look at UNESCO world heritage sites. Every now and then you get stopped at a "checkpoint" where you are asked a multiple choice question about HIV/AIDS. It is not clear what the world heritage sites have to do with HIV/AIDS, and there doesn't appear to be anywhere in the game where players can learn the answers to the questions before they are asked.

Final Fantasy
Final Fantasy (1987–2016), Square Enix (Developer), Square Enix, (Publisher),

Genre: RPG.
Subject: Science Fiction Fantasy.

Synopsis: This is one of the most successful RPG series of all time. The 1st installment of the series was released in 1087 and the 15th is due out in 2016. While each installment involves different characters and challenges, all take place in the same "universe." Players play as a character of a particular race that has certain strengths and weaknesses.

FloodSim
(2008) PlayGen (Designer) Norwich Union (Publisher), [Browser], Game Site: http://floodsim.com/.
Genre: Simulation.
Subject: Environmental Science, Policy.
Synopsis: A game that allows players to make policy decisions about flood policy and see the results.

Food Force
(2005) United Nations World Food Programme (Designer) Deepend and Playerthree (Developer), United Nations World Food Programme (Publisher), [Windows], Game Site: http://www.wfp.org/videos/food-force-promo.

Rating: T	Genre: Serious Strategy Managerial, Top-Down Adventure, Helicopter, Managerial	Educational: Health/Nutrition, Science
Subject: Global Affairs, Social Studies.		

Synopsis: This game takes players on six missions to supply aid to a fictional nation that is experiencing civil war and famine. It is meant to help players gain an understanding of the challenges faced when trying to provide aid.

Food Chain Game
J. Chapgar (Designer) Sheppard Software (Publisher), Game Site: http://www.sheppardsoftware.com/content/animals/kidscorner/games/foodchaingame.htm.

Subject: Science, Food Chain	Grade: 1–3.

Synopsis: A drag-and-drop game that lets you place items of a food chain in the correct order. Once you do, the items are briefly animated.

GameMaker
(1999) Game Development Tool, Produced by: Mark Overmars, Published by: YoYo Games, URL: www.yoyogames.com/make

Rating: E	Genre: Game Engine
Cost: Free/Professional Versions available	Grade: All

Synopsis: GameMaker is a development tool for making games. It does not require programming knowledge, but does have a scripting language that can be learned if desired.

Gone Home

(2013) [1st-Person] T. Fullbright Company LLC (Developer), Fullbright Company LLC, The (Publisher), [Linux, Macintosh, Windows], Game Site: http://www.gonehomegame.com/.

Rating: T	Genre: Adventure	Perspective: 1st-Person.	
Cost: $20 (2015)	Subject: English	Grade: 10–12	Time to Play: 3 h.

Synopsis: Gone Home is a mystery game that is played entirely inside a single house. You play as a 20 year old woman named Kaitlin who arrives home after a trip to Europe. The game starts with Kaitlin on the porch where she can see a note on the door from her sister Sam. The house is empty but we are free to explore its entirety and examine almost all items. There are a few places that are locked and must be unlocked using clues found elsewhere, but most of the gameplay is nonlinear in that players are free to explore anything they want in any order. There is an audio diary that's been left by Sam and certain items trigger entries that you can hear. The game ends when you discover when has happened to your parents and sister.

Half-Life 2

(2004) Valve (Designer) [1st-Person] Valve LLC (Developer), Vivendi Universal Games (Publisher), [Computer], Game Site: http://www.half-life2.com.

Rating: M	Genre: 1st-Person Action, Puzzle-Solving, Sci-Fi, Furturistic, Shooter	Perspective: 1st-Person.

Synopsis: Half-Life 2 is about a dystopian alternate history of Earth, where the all resources of the planet (including the people) are being harvested by an oppressive multidimensional empire, known as the Combine. It is set about 20 years after Half-Life 1. The aliens have locked human breeding for the time being. Gordon Freeman, the hero form the first game, is returned from wherever he was (some sort of void/stasis) by the mysterious suited man to aid the resistance against the aliens.

Journey

(2012) [3rd Person] L. thatgamecompany (Developer),Game Site: http://thatgamecompany.com/games/journey/.

Rating: T	Genre: Meditative/Zen Action	Perspective: 3rd Person.

Synopsis: Sand, silence, and searing sun. A vast desert stands between you and your goal: a lonely mountain peak far in the distance. But don't fret! Friends from around the world are making the trek with you, ready to jump in and help you along the way. The only catch? You can only communicate through a single, simple chime. How will you work together to overcome to obstacles ahead? Perhaps the Journey really is more meaningful than the destination. Travel through the world of a lost civilization and discover what happened to them. The game is online, but you cannot choose who you play with or communicate other than the games built in "singing." Designed to create a sense of awe and wonder, at which it largely succeeds.

Katamari Damacy
(2004) [3rd Person] Nintendo Limited (Developer), Namco Hometek Inc. (Publisher), [PS2], Game Site: http://katamari.namco.com/.

Rating: E	Genre: puzzle/trivia/parlor	Perspective: 3rd Person.

Synopsis: Katamari Damacy is a well-known, critically acclaimed game with a relatively simple goal, which is to roll up objects into a large "ball," called a katamari. The main premise for this game is that the King of All Cosmos has accidentally destroyed the stars in the sky so he charges his son, the Prince with replacing them. This is to be accomplished by going to Earth with a sticky ball called a katamari and rolling it over various objects. As the Earth is deemed to have a great many items, the Prince is to roll up as many as he can in a given time period and the King will launch the resultant ball into the sky to create a new star. There are also constellations to be made which include a additional challenge of rolling up specific kinds or objects, such as bears to create Ursa Major.

The Legend of Zelda: Ocarina of Time 3D
(2002) S. Miyamoto (Designer) [3rd Person] L. Grezzo Co., Nintendo EAD (Developer), Nintendo of America Inc. (Publisher), [Nintendo 3DS], Game Site: http://www.zelda.com/universe/.

Rating: E	Genre: Fantasy, Puzzle-Solving	Perspective: 3rd Person.

Synopsis: This is a 3D remake of the original 1998 game about a boy named Link who is asked by the Deku Tree to find the princess Zelda. There are various puzzles to solve and challenges to meet.

Math Blaster!
(2007–2014) J. Davidson (Designer) [Full Shot, Eye Level View] Knowledge Adventure Inc. (Developer), Knowledge Adventure, Inc. (Publisher), [Web (Unity) Mobile], Game Site: http://www.knowledgeadventure.com/mathblaster/preview.aspx.

Genre: Side-Scrolling, Platform	Perspective: Full Shot, Eye Level View.		
Cost: iTunes $1.99 (2015); Online freemium. There are various licensing models for teachers and schools.	Audience: S. Homeschool	Subject: Math	Grade: 1–6.

Synopsis: Mathblaster is an educational game that claims to meet curricular requirements in math for a wide variety of grades. Although the game has evolved over the years, it is still in many ways the same game that it was in 1987.

Limbo
(2010) [3rd Person] Playdead ApS (Developer), Playdead ApS (Publisher), [all].

Genre: Platform, Side-Scrolling, Horror, Puzzle-Solving	Perspective: 3rd Person.

Synopsis: In this game you play as The Boy who is searching for his sister. Your world is a gloomy monochrome world that you must try to navigate without dying.

Machinarium
(2009) [3rd Person] Amanita Design s.r.o (Developer), Amanita Design s.r.o (Publisher), [Android, Fire OS, iPad, Linux, Macintosh, Ouya, PlayStation 3, PS Vita, Windows, Windows Phone], Game Site: http://machinarium.net/.

Genre: Puzzle-Solving, Sci-Fi/Futuristic, Adventure	Perspective: 3rd Person.

Synopsis: Machinarium is a point-and-click puzzle game. You play as a small robot who is searching for his girlfriend. The player can't die and has access to a cryptic walk-through book that contains no text, only sketches of clues. There is no dialog although some communication is done through the use of speech-bubbles that are themselves images. There are no time-pressures until the very end, so players can proceed at their own pace.

Mad City Mystery
(2009) Academic Advanced Distributed Learning Co-Lab AADLC (Developer),[Handheld Smart Devices], Game Site: Unavailable.

Genre: Environmental Augmented Reality.
Time to Play: 90 min.

Synopsis: Players interact with virtual characters in this augmented reality game in order to help a police examiner solve a murder mystery.

Minecraft
(2011) [1st-Person] Mojang AB (Developer), Mojang AB (Publisher), [Browser / Mobile], Game Site: http://minecraftedu.com/.

Genre: Simulation	Perspective: 1st-Person.		
Cost: $18 single user; $41/server	Audience: Everyone	Subject: Math, Various	Grade: Any.

Synopsis: "Minecraft is a game about breaking and placing blocks" Minecraft.Net. The educational version has retained the basic functionality but added extensive teacher controls leaving us with an open sandbox version of the original game suitable for use in classroom settings.

Monument Valley
(2014) [Isometric] Ustwo Studio Ltd., (Developer), Ustwo Studio Ltd. (Publisher), [Android, iPad, iPhone, Windows Phone], Game Site: http://www.monumentvalleygame.com/.

Rating: E	Genre: Puzzle-Solving Strategy	Perspective: Isometric.

Synopsis: This is a visual puzzle game where the player helps Princess Ida navigate a variety of Escher inspired settings by rotating and moving parts of the structures. Each level presents a different colored setting. There are no time limits but Ida must avoid the black crow people who often block her passage. They cannot harm her, but they do watch her whenever she is near them so it can be challenging to sneak past them.

Myst
(1993) Brøderbund Software Inc. (Designer) Cyan Worlds Inc. (Publisher), [PC], Game Site: Myst.

Rating: T	Genre: Adventure.

Synopsis: Myst is a puzzle game that takes place on the Island of Myst. You find yourself alone and discover a mystery about the people that were once there but are now gone. Solving the puzzles (some of which are very difficult) allows you to access further clues and travel to other places.

New Super Mario Bros.
(2006) S. Miyamoto (Designer) Nintendo (Developer), Nintendo (Publisher), [Nintendo DS], Game Site: http://mario.nintendo.com/.

AKA: NSMB	Rating: E	Genre: Platform, Side-Scrolling, Strategy, Puzzle-Solving, Side-Scroller.

Synopsis: A classic platformer that involves completing various challenges that are essentially obstacle courses. The accompanying narrative is that Bowser (the bad guy) has kidnapped Princess Peach and now Mario must overcome various challenges to retrieve her.

Oregon Trail, 3rd Edition
(1997) MECC (Designer) [3rd-Person, Isometric] The Learning Company (Developer), MECC, The Learning Company (Publisher), [Apple II, DOS, Windows, Windows 3.x].

AKA: Oregon Trail	Genre: Adventure, Educational, Role-Playing (RPG), Simulation, Strategy, Hunting, Managerial, Real-Time, Side-Scrolling	Perspective: 3rd-Person, Isometric.
Subject: Geography, History	Time to Play: Computer Game.	

Synopsis: You are part of a convoy of pioneers travelling by covered wagon from Independence, Missouri to the Willamette River and valley in Oregon. You and your family must find ways to survive by hunting, trading, and avoiding danger.

Osy Osmosis
(2012) [Top-Down] IS3D (Developer), University of Georgia, (Publisher), [Browser/Mobile Game], Game Site: http://www.osyosmosis.com/.

Genre: Quest	Perspective: Top-Down.
Cost: $4.00 (mobile in 2014)	Subject: Science: Osmosis.

Synopsis: "Students must help "Osy" stay safe as she navigates through her world collecting stars and using osmosis to keep her in balance with the space around her. Cogent Education's "Osy Osmosis" won District Administration's 2015 Top Product Award and the company's flagship product "Interactive Cases" have won numerous education awards as well." Osy Osmosis

The Orange Box
(2007) [1st-Person] Valve Corporation (Publisher), [PlayStation 3, Windows, Xbox 360].

Rating: T-M	Genre: Puzzle-Solving, Action Shooter, Compilation/Shovelware	Perspective: 1st-Person

Synopsis: The Orange Box is a compilation of the following games: Half-Life 2, Half-Life 2: Episode One, Half-Life 2: Episode Two, Team Fortress 2, Portal.

The Parable of the Polygons
(2014) [3rd Person] Vi Hart & Nicky Case (Developer), Vi Hart & Nicky Case (Publisher), [Browser], Game Site: http://ncase.me/polygons/.

Rating: E	Genre: Serious Game	Perspective: 3rd Person.
Cost: Free	Subject: Social Studies, Diversity and Racism	Time to Play: 15–30 min.

Synopsis: This is a game that is presented as a playable blog post and consists of little blue square and yellow triangle characters. The object is to rearrange the characters to make them all happy. The problem is that the squares aren't completely comfortable living next to the triangles and vice versa. To make them all happy, you need to find just the right configuration.

Pavlov's Dog
(2001) Nobel Media AB., (Publisher), [Browser (Flash 6)], Game Site: http://www.nobelprize.org/educational/medicine/pavlov/.

Rating: E	Genre: Educational.	
Cost: Free	Subject: Science, Classical Conditioning	Time to Play: 5–10 min.

Synopsis: The object of the game is to train Pavlov's dog to respond to a signal that it will associate with being fed. Choose the right signals with his food and you will become successful; choose the wrong options and the dog will refuse to respond to your signals.

Phoenix Wright: Ace Attorney
(2005) Capcom Co. Ltd. (Designer) [1st Person] S. Takumi (Developer), Capcom Co. Ltd., (Publisher), [Nintendo DS], Game Site: http://www.capcom.com/phoenixwright/.

Genre: Branching Story, Adventure, Simulation, Anime/Manga, Detective/Mystery, Puzzle-Solving	Perspective: 1st Person.

Synopsis: In this game we play the role of Phoenix Wright, a newly minted defense lawyer taking on his first cases. The game consists of five separate cases each involving a murder investigation that culminates in a trial which we must win. Each of the main characters has interconnecting back stories, bits of which are revealed from time to time through the five cases. In all cases the person accused of the crime is innocent and it is our job to gather evidence and other clues which will be used to argue our case during the trial in order to have our client found not guilty. We must also discover who the real killer is. It should be noted that although it is possible to learn some of the terminology associated with the legal system through playing this game, the game's designers make no claim as to the accuracy of the court procedures or any other legal aspect of the game.

Pikmin
(2001) S. Miyamoto (Designer) [3rd Person] Nintendo (Developer), Nintendo (Publisher), [GameCube], Game Site: http://www.pikmin.com/launch/.

Rating: E	Genre: 3rd-Person Strategy, Puzzle-Solving, Real-Time	Perspective: 3rd Person.

Synopsis: You are captain Olimar, who crash-lands on an unexplored planet, and you must enlist the help of little Pikmin (a kind of highly social plant/insect) to help you find the various bits of your ship so you can put it back together and get home.

Pong
(1972) [Computer, Console], Game Site: http://www.pong-story.com/.

Synopsis: One of the earliest digital games to become known, Pong is a ping-pong game played either with two players or with one player against the computer.

Portal for Education
(2011) Valve Corporation (Designer) Electronic Arts (Publisher), [Computer], Game Site: http://www.thinkwithportals.com/.

AKA: Portal 2	Genre: Action Puzzle.			
Cost: Free	Audience: 10+	Subject: Math and Physics	Grade: 4+	Time to Play: Puzzle, first-person, science fiction.

Synopsis: This is an educational version of the original Portal 2, which is in turn a sequel to the original Portal. The Puzzle Builder allows players to create their own rooms and populate it any way they choose. In these rooms they have access to all the tools that are available in the original game and this in turn allows players to experiment with time, gravity, momentum, distance, and other physical elements. The interface is very powerful yet easy to use and as a result provides a virtual lab that can be used in a wide variety of ways.

Professor Layton and the Curious Village
(2007) Level-5 Inc. (Developer), Nintendo (Publisher), [DS], Game Site: http://professorlaytonds.com/curiousvillage/.

AKA: Professor Layton	Genre: Adventure, Educational, Strategy.

Synopsis: This is a puzzle game wrapped in an entertaining mystery narrative. In this case the mystery revolves around a village where strange things happen and we must find out why. The people we must talk to help us solve the mystery often present us with puzzles they want us to solve. The puzzles in the game are sometimes straight-forward but often quite challenging and make for good brain-teasers.

Psychonauts
(2002), Double Fine Productions (Developer), Microsoft (Publisher), [Xbox,PC], Game Site: http://www.psychonauts.com/

Genre: Action

Synopsis: A young boy named Raz who has unusual psychic ability goes to a camp for up-and-coming psychics. Evidence that someone is tampering with the campers' minds psychically is discovered and Raz is the only who can stop it. This game is unusual in that it plays out largely inside the heads of the characters. Raz has the ability to project himself into the psyches of the other characters and uses this to solve the mystery.

Railroad Tycoon
(1990) S. Meier (Designer) I. MicroProse Software (Developer), MicroProse Software, Inc. (Publisher), [PC], Game Site: http://www.2kgames.com/railroads/railroads.html.

Genre: Simulation.

Synopsis: In this game you begin with a sizable loan of money to build a railroad. You can choose from among four scenarios to build a successful railroad enterprise. Your job is to build it in such a way that the revenue keeps you afloat.

Privacy Playground: The First Adventure of the Three CyberPigs
(2010) Mediasmatrs.ca (Developer), Mediasmatrs.ca (Publisher), Game Site: http://mediasmarts.ca/game/privacy-playground-first-adventure-three-cyberpigs.

AKA: Privacy Playground	Genre: Educational.
Cost: Free	Audience: 8–10.

Synopsis: This "game" is meant to help kids learn how to be aware of various online privacy issues. The main characters are cyber-pigs who take you through a click-and-click story which halts a various points to ask you yes/no questions. The characters are kind of cute, but as a game, it leaves much to be desired.

Real Lives II
(2009) E. Simulations (Designer) [Windows] Educational Simulations (Developer), Educational Simulations (Publisher), [Educational, Role-Playing, Simulation, Geography, History, Sociology], Game Site: http://www.educational-simulations.com/.

AKA: Real Lives	Rating: E	Genre: Simulation	Perspective: Windows.
Cost: $29 (2015) multiple copy pricing available	Subject: Social Studies	Grade: 4 and Up	Time to Play: Computer Game.

Synopsis: Real Lives simulates the life of one person using values and probabilities based on real statistics. When you start the game you are assigned an identity that is chosen using global statistics. As a result, the chances of being born a middle class Canadian, for example are extremely slim. It is a turn-based game where you can make various choices about such things as whether or not to go to school or how to spend the money you have, and then the game advances your life by 1 year and you get to see how things have changed.

Roller Coaster Tycoon 3
(2004) Frontier Developments Ltd. (Designer) Frontier Developments Ltd. (Developer), Atari Inc., (Publisher), [PC], Game Site: http://www.atari.com/rollercoastertycoon/.

Genre: Real Time Strategy.	
Grade: 3+	Time to Play: console.

Synopsis: This game is similar to the other Tycoon games in that you begin with a finite amount of resources and you are to use that to build a zoo. Your goal is to create one that keeps the animals happy and healthy as well as one that generates sufficient revenue to keep your enterprise going.

Scratch
(2002) MIT Media Lab Lifelong Kindergarten Group (Developer), URL: https://scratch.mit.edu/about/

Rating: E	Genre: Programming Language.
Cost: Free	Grade: all

"Scratch is a programming language and online community where you can create your own interactive stories, games, and animations—and share your creations with others around the world. In the process of designing and programming Scratch projects, young people learn to think creatively, reason systematically, and work collaboratively." *Source*: Scratch website.

Scribblenauts
(2009) 5TH Cell Media (Developer), Warner Bros. Interactive Entertainment Inc., (Publisher), [Nintendo DS, Mobile], Game Site: http://www.scribblenauts.com/scribblenauts/unmasked.

Genre: Action, Strategy.
Subject: Vocabulary, Logic.

Synopsis: Scribblenauts is a side-scrolling action puzzle game. In each round you are to reach the star and can ask for virtually any object to help you, such as ladders, planes, dragons, wings, and even nuclear bombs. If you can type it, you can ask for it and use it. The dictionary contains more than 20,000 words so the possibilities are almost limitless.

September 12
(2003) [Isometric side-scroller] Newsgaming.com (Developer), Newsgaming.com (Publisher), [Browser], Game Site: http://www.newsgaming.com/games/index12.htm.

Genre: Educational, Simulation	Perspective: Isometric side-scroller.	
Cost: Free	Audience: Young Adult and up	Subject: Social Studies, History.

Synopsis: The overall intent of this game is clear. The main message of the game is that violence begets more violence. The game consists of a Middle Eastern village with villagers going about their business. Some of the people in the village can be identified as terrorists by their clothing. The player controls a missile that can be fired. It is not possible to hit any target without collateral damage. Civilians who come to mourn those killed sometimes turn into terrorists.

School Daze Crazy Maze
PBS Kids (Publisher), Game Site: http://pbskids.org/itsmylife/games/middle-school_flash.html.

Rating: T	Genre: Educational, Puzzle.
Cost: Free	Grade: 4–9.

Synopsis: In this game you are given a variety of challenges to meet that involve finding your way through the school. Practice scheduling, navigation and time management in this interactive maze race. Follow a map and class schedule and move your symbol through the maze to your next class before the tardy bell rings.

Second Life

Second Life (2002–2016) Produced and Published by: Linden Lab, URL: http://secondlife.com/

Genre: A free online virtual world. It is primarily meant for adults—participants must be 18+ to sign up. It includes a sophisticated scripting language that allows players to build anything from clothing and functioning pencils to entire countries. The majority of the content in the world is user created.

Stalin's Dilemma

(2000) E. Bever (Designer) Freeware (Publisher), [Windows].

AKA: Games/Stalin	Genre: Educational, Simulation, Strategy, Managerial.
Subject: History	Time to Play: Computer Game.

Synopsis: This is a spreadsheet style game where you have a large number of variables you can set that relate to the economy and functioning of your region. You have a finite number of resources that you must spread around, and once you have done that you can run the game and find out how you did.

Team Fortress 2

(2007) [1st-Person] V. Corporation (Developer), Buka Entertainment (Publisher), [Linux, Macintosh, Windows].

Rating: M	Genre: Action Shooter	Perspective: 1st-Person.

Synopsis: Team Fortress 2 is a humorous first person team death match shooter. Go online and join a match of several game types. The goal depends on the type of match, get a certain score of kills either alone or as a team, capture the flag, or hold the "bag" for the longest.

Tekken 4

(2001) [3rd Person] N. Limited (Developer), Namco Limited (Publisher), [Arcade, PS2], Game Site: http://www.tekken-4.com/splash.html.

Rating: T	Genre: Anime/Manga, Fighting, Sci-Fi/Futuristic	Perspective: 3rd Person.

Synopsis: Tekken is a martial arts tournament. Each character has its own martial arts style, as well as their own motivations for entering the tournament. The main character appears to be Jin, who is part demon. His grandfather is the original champion, and his father is also entered.

Tetris
(1986) Elorg (Designer) AcademySoft (Developer), Mirrorsoft Ltd. (Publisher), [DOS].

Genre: Puzzle-Solving, Real-Time Strategy.	

Synopsis: The ultimate packing game. Different shaped blocks descend from the top of the screen and your job is to rotate and shift them so that when they hit bottom they combine to form solid layers. This is a never-ending game that continues until the screen is filled with layers you can't eliminate.

Ultima Online
(1997) R. Koster (Designer) [Top-Down] Electronic Arts, Origin Systems, Mythic Entertainment (Developer), Electronic Arts, (Publisher), [Online], Game Site: https://uo.com/.

Genre: MMO	Perspective: Top-Down.

Synopsis: Widely recognized as the first persistent world online game. Players create virtual citizens in this open-ended game. Just like in most RPG's, characters are advanced through skill, gained by fighting monsters in dungeons, or practicing a craft (or both).

Where in the World is Carmen Sandiego?
(1985) I. Broderbund Software (Designer) Broderbund (Developer), Broderbund Software, Inc. (Publisher), [Amstrad CPC, Apple II, Commodore 64, DOS, SEGA Master System].

AKA: Carmen Sandiego	Genre: Detective, Mystery, Puzzle-Solving, Educational, Geography.
Subject: Geography.	

Synopsis: This is a game where players must use their knowledge of geography to track down a master thief. In addition to finding out where the thief is, players must also figure out who the thief is by figuring out clues so that they can get a warrant to arrest the suspect. The ultimate goal is to find Carmen herself.

Wii Sports
(2006) [3rd Person] L. Nintendo Co. (Developer), Nintendo of America, Ltd. (Publisher), [Wii], Game Site: http://wii.nintendo.com/software_wiisports.jsp.

Rating: E	Genre: Sports Arcade	Perspective: 3rd Person.

Synopsis: Wii Sports is a collection of games that was released with the Wii when it was a new console. It included: Tennis, Bowling, Baseball, Golf, and Boxing. The characters are all Miis, who are cartoonish avatars that can be created through Wii's Mii channel.

World of Warcraft
(2004) Blizzard Entertainment Inc. (Designer) [1st Person] Blizzard Entertainment Inc., (Publisher), [Online], Game Site: http://www.worldofwarcraft.com/index.xml.

AKA: WoW	Rating: T	Genre: Action, Adventure, Role-Playing (RPG), Medieval/Fantasy, Persistent Universe, Real-Time	Perspective: 1st Person.

Synopsis: World of Warcraft is an online RPG with several story arcs depending on the region of the game you are in, and the levels of your character. Primarily there are two factions, the alliance of "good" races, and the horde of "questionable" morality (though some quests seem to imply the alliance isn't all that good, and the hoard is very honorable). Players can join either faction and adventure across the land with their friends, and make new friends as they go. The objective at the "end-game" has become (set by players actions more than the company) to acquire the best gear through difficult raids that require many people to accomplish.

You're In Charge
(2005) I. CastleWorks (Developer), PBS Kids (Publisher), Game Site: http://pbskids.org/itsmylife/games/in_charge_flash.html.

Genre: Educational.

Audience: 7+.

Synopsis: Mom has left you at home while she goes to the office. You are left in charge of the house and your little brother until your mother returns at 7 p.m. You can earn points by behaving responsibly, and lose points by acting irresponsibly. You can interact with various items in the house, and occasionally the phone will ring or someone will come to the door.

You Make Me Sick
(2011) F. Games (Developer),[Browser], Game Site: https://www.filamentgames.com/bacteria-and-viruses-unit-you-make-me-sick.

Genre: Educational.

Cost: $5.99 per account (2015)	Subject: Science	Grade: Middle School.

Synopsis: The goal of this game is to teach about bacteria and viruses and how they are spread. It takes place in an apartment where the pathogen you have designed is set loose to infect the host that lives there.

Zoo Tycoon 2
(2004) J. Surprenant (Designer) Blue Fang Games, LLC (Developer), Microsoft Game Studios (Publisher), [Windows], Game Site: http://www.microsoft.com/games/zootycoon/zoo2/.

Genre: Educational, Simulation, Strategy, Managerial, Real-Time, Ecology/Nature.

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