Leslie Moller
Jason B. Huett *Editors*

The Next Generation of Distance Education

Unconstrained Learning

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Editors
Leslie Moller
Professor, Educational Tech.
Walden University
Minneapolis, MN 55401, USA
lesmoller@aol.com

Jason B. Huett
Assoc. Dean, Online Develop.
and USG eCore
University of West Georgia
Carrollton, GA 30118, USA
jhuett@westga.edu

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Introduction

Soon we'll be shipbuilding …

– Elvis Costello

That sound you hear is the dam cracking…

Our learning landscape is being fundamentally altered. After decades of living behind a dam protecting us from the wave of educational and technological change crashing against our walls, the dam is about to give way. If you listen carefully, you can hear this barrier, originally constructed by deep-rooted educational, political, and social systems, groaning under the strain.

Why now? The short answer is that Web-based technologies are revolutionizing learning and reshaping the educational process. After all, who could have anticipated 100, 50, or even 25 years ago that a learner, sitting in front of a device no bigger than a stack of books, would be able to access practically limitless knowledge to create a personalized learning environment that literally knows no bounds? Now, we find modern learners being continually connected to new and ever-evolving content that addresses their personal learning needs in ways unimagined just a few years ago. Without question, unprecedented access to information, new technologies, and a new sense of openness and collaboration are changing education and the world at large.

There is also a raw sense of empowerment in the learning process that is flowing worldwide. This newfound autonomy is equalizing the educational playing field between social classes and between countries and is placing control of the learning process in the hands of the individual—where many argue it rightly belongs.

However, there appears to be a disconnect between what we know is happening in the real world and what we do in our classrooms, both local and distant, at all levels of instruction. While one can point to isolated instances of real reform (and those should not be overlooked), in many ways, it is as if schools exist in a vacuum, suspended in time, while the world streaks by. There is little real effort, on a systemic basis, to access and participate in the new and unique learning opportunities that technology brings to students regardless of age, race, background, or financial status.

For the first time in our history, the educational establishment is facing real competition, and it is not from the school in the next county or the regional university down the road. It is coming from the Web. A new generation of learners is calling for new ways to learn and is demanding untethered educational access. There has been a literal explosion of distance education opportunities, and research is now showing that the average distance learner performs as well as (if not better) than the average traditional student in many learning contexts. Combine this with next generation technology-enabled learning environments, and one has nothing short of a modern learning renaissance brewing.

So, what happens to our current educational system when access to on-demand, personalized, high-quality, technology-enabled learning begins to be a viable option for students at all levels? What do you do with a knowledge environment that allows anyone to learn anything at any time or place?

Welcome to the new paradigm of unconstrained learning.

It was thoughts like this that drove the call for presenters to the *2010 Association for Educational Communications and Technology (AECT) Summer Research Symposium*. The symposium brought together scholars, theorists, researchers, and other creative thinkers for an intimate conversation about their research into the next generation of distance education and the principles that should guide effective practice as we advance toward a new learning model unconstrained by time and space.

This book is the result of that summer collaboration and our attempt to showcase how the untapped power of technology combined with research-based, knowledge-building pedagogy can begin to create a blueprint for the future of the next generation of distance education. This book is a start down the path toward an answer, but there is much more work to be done. It is our hope the book will inspire you to imagine what is possible now, what will be possible, and how you can have a positive impact on the new learning landscape.

I would be remiss if I did not take the time to thank several individuals who helped to make the symposium, and this book, possible. I had the honor of cochairing the symposium along with my friend, colleague, and coeditor Leslie Moller. Leslie is one of the originators of the *AECT Summer Symposium* concept and deserves a great of deal of appreciation for his hard work in making these biannual events a success.

I would also like to acknowledge and thank *AECT* Executive Director Phillip Harris, as well as Larry Vernon, Judy Tackitt, and the rest of the *AECT* staff for helping to organize the symposium and for handling every issue, no matter how large or small, with grace, efficiency, and a sense of humor. I would also like to recognize and thank Michael Spector, Andrew Gibbons, and Gary Morrison for serving on the symposium advisory board and for participating in the symposium and the book. Appreciation also goes out to all the other symposium participants as well as the faculty, staff, and students of the University of Indiana for hosting the symposium.

In closing, I would like to thank the contributors to this book as they are explorers in the truest sense of the word. They know that the dam is giving way, and rather than trying to plug the leaks or heading for higher ground, they are attempting to help build the ships that will allow us to set sail on new educational waters.

I hope that you enjoy the book and that you find within its pages something that inspires you to set out on your own voyage for new educational frontiers.

Smooth Sailing,

May 2011, Isle of Skye, Scotland Jason B. Huett

"This book is the result of the 2010 AECT Research Symposium"

Preface

It is time to move the definition of distance learning beyond the metaphor of equivalence to the classroom. Distance learning is rapidly developing new learning environments, which are to be understood on their own merits, rather than by comparison to the familiar campus-based experience. On this, the contributors to this volume would likely agree. While it is premature to expect broad consensus on this definition of this next generation of distance learning, the authors contributing to this volume shed light on some of its likely properties—as well as demonstrating a divergence of views. From this dialog, five broad themes emerge:

Diversity of context: Tradition leads us to the familiar structure of the semester or quarter, the course, and class and the lesson. But in the world of online, continuous learning, many of the authors seem to recognize that the conventional structure is no longer the only option, which should be available. For example, Schwier (Chap. 9) argues that formal learning environments represent only one end of a continuum, with informal learning at the other end of the continuum, and self-directed learning skills playing an increasingly important role. The range of options available is further explored by Cleveland-Innes and Garrison (Chap. 15). The theme here seems to be that the affordances of the online world have led to greater awareness of the many ways learners learn what they learn, and know what they know. If it ever did make sense to design a course as a self-contained, uniform learning experience, that certainly is not the case now. Instead, we can envision online learning environments in which the learners draw on and manage their learning using the full resources of the Web, and the principal activity of the online "class" and the faculty member(s) involved is to mentor and facilitate reasoning, sense-making, and self-directed learning.

Multiple knowledge types: An axiom of instructional design is that different knowledge types require different strategies for instruction and learning. The same could be said of knowledge management systems, as pointed out by Wognin, Henri, and Marino (Chap. 12). This point is important because of the increasing role of various types of intelligent agents in our online working environments, as well as the way in which we allocate the work of formal and informal learning to different knowledge types. For example, we are already at the point where almost any kind of data can be instantly retrieved online; a clear implication is that learning to synthesize those data into information, and transform the information into knowledge and—ultimately—wisdom becomes the primary goal of formal learning. The simple organization, transmission, and memorization of factual data are no longer worth the instructor's or the student's time, whether online or in the classroom. Any knowledge worker, including our students, should have the habits of mind and the skill set to start any new task with the quick retrieval of the most current data from appropriate sources. All knowledge work begins as a "mashup" (whether done with post-it notes on a board or in a notes program), and the next generation of distance learning should help learners to become skilled in doing it well, within their chosen domain. The technology allows many new forms of knowledge representation, which go well beyond the conventional scholarly forms, and the next generation of students needs to use them all well.

Collaboration and social learning: Many of the contributors chose to explore the complex issues of online collaboration, especially in asynchronous learning environments. We have learned that, whether online or on campus, truly meaningful and productive interaction among learners must be carefully structured and supported, if it is to achieve its goals of building higher-order knowledge and reasoning. This is a challenge in all environments, and it demands considerable skill of both the instructor and the learner. We are still learning how to make this kind of effective collaborative learning a reliable component of any learning environment. The observations by Moller, Robison, and Huett (Chap. 1); Shepard (Chap. 8); and McKeown and Howard (Chap. 6) are representative of current thinking.

The other important reason for collaboration online is to facilitate the important social learning outcomes of the online learning environment. The critical nature of the social learning environment is highlighted by Liu, Carr, and Strobel (Chap. 14), both for instructors and students. It could be an important reason to incorporate video in both synchronous and asynchronous environments, as the work of Maddrell and Watson (Chap. 11) may come to demonstrate. The interaction of collaborative work and social interaction is further discussed by Ghosh, Rude-Parkins, and Kerrick (Chap. 13).

The next generation of distance learning environments should support social learning as effectively as it supports cognitive learning. Of particular interest here is the design studio metaphor with its multiple levels of critique, as described by Hokanson (Chap. 5). He speculates on how parts of the student experience might be implemented online, while cautioning that much could get lost in the translation of what has traditionally been an intensive face-to-face experience.

Application of basic principles of instructional design: Authors who specialize in a given learning technology tend to claim, implicitly or explicitly, that theirs is unique, and the "old ways" are no longer valid with the new tools. In our discussions of the next generation of distance learning, we need to resist this urge and remind ourselves that the principles of instruction and learning still apply—though the way they are manifested may change. This is the message of Spector (Chap. 2) and of Abrami, Bernard, Bures, Borokhovski, and Tamim (Chap. 4), as well as the bibliography provided by Morrison and Greenwell (Epilogue). This principle is also one of Moller, Robison, and Huett (Chap. 1). The field will move forward only through disciplined, cumulative knowledge building.

There is another implication, as we design the next generation of distance learning environments: We need to remember that these environments are created by specialists from many fields, who may or may not have the luxury of a trained instructional designer contributing. Thus, there is a great need to build tools and intelligent agents to help assure that the learning environments created actually implement what we know about instruction and learning.

Implications for instructional design processes: Creation of distance learning environments has become a task, which is distributed in time and space, across many actors filling many roles, who may or may not act as a team. The design process and project management assumptions of the ADDIE model are a poor fit to this environment, and the field has responded with a great deal of interest in the metaphor of the design culture as an alternative. Gibbons and Griffeths (Chap. 3) propose a new taxonomy of *designed artifacts* as a framework for thinking of how the components of a learning environment are created and assembled. Reese (Chap. 10) reports on a design framework for serious games—one class of such artifacts.

Another dimension of the dialog on design processes has been left implicit by the authors in this volume, however: The resource requirements and life cycle costs of distance learning design and development. It should be clear that many of the main drivers or constraints for change to this new generation of distance learning are economic. In the current practice, we have observed that starting with the cost and life cycle assumptions of the campus classroom has been an all but insurmountable barrier to satisfactory instructional design. In addition, the structures and traditions of today's postsecondary institutions usually preclude the economies of scale, which would allow more costly and sophisticated designs. This cannot be true of the next generation of distance learning. It remains to be seen if the assumptions of the traditional postsecondary institution can be overcome, or if the next generation of distance learning will grow only in new cultures found exclusively in online institutions. It could be that the kind of design culture contemplated here will prevail, precisely because it is more capable of economies of scale through reuse of many of its component learning objects, drawn from many sources. Our goals in developing the next generation of distance learning design processes and tools should be both efficiency and effectiveness—if we want our vision to become the predominant reality.

Taken together, these chapters are a useful start to our thinking about how to move distance learning beyond the classroom metaphor and define it on its own terms. Through the multiple perspectives offered by these authors, we can see movement toward a future that embraces multiple types of learning experiences and roles for the learner and the instructor(s), and unified by common goals and emphasizing collaborative and social processes. Inherent in this view is support of multiple paths to multiple learning goals. We can envision distance learning environments which are assembled for the purpose as much by the learner as by the instructor (and instructional designer), drawing on multiple sources for their components, and including both data and information, and Gibbons and Griffths' designed artifacts (or some other definition of learning objects). The skills of both instructor and learner in scaffolding and facilitating the collaborative learning process become paramount. The chapters in this volume offer important first steps toward a coherent consensus for the definition of the next generation of distance learning environments.

Minneapolis, MN, USA Wellesley R. (Rob) Foshay

Contents

Author Biography

Philip C. Abrami is a Concordia University Research Chair and the Director of the Centre for the Study of Learning and Performance. His current work focuses on research integrations and primary investigations in support of applications of educational technology in distance and higher education, in early literacy, and in the development of higher order thinking skills.

Gary J. Anglin serves as a faculty member and Program Coordinator of the Instructional Systems Design Program at the University of Kentucky. His educational background includes degrees in mathematics and degrees in instructional systems technology from Indiana University. He teaches graduate classes in the areas of instructional design, instructional theory, distance learning, and foundations of instructional technology. Dr. Anglin has served as president of the Research and Theory Division, and the Division of Instructional Development, and currently chairs the Robert M. Gagne Award Committee for Outstanding Graduate Student Research, Association for Educational Communications and Technology. He is also a past president of the Instructional Technology Interest Group (IT-SIG) of the American Educational Research Association. His recent publications have been in the area of distance learning, and he is the editor of the forthcoming book (in press), *Instructional Technology: Past, Present and Future* (3rd ed.).

J. Ben Arbaugh is a Professor of Strategy and Project Management at the University of Wisconsin Oshkosh. He received his Ph.D. in Business Strategy from the Ohio State University. Ben currently is Editor of *Academy of Management Learning and Education*. He was the 2009 GMAC Management Education Research Institute Faculty Research Fellow, and a past chair of the Management Education and Development Division of the Academy of Management. Ben's online teaching and learning research has won best article awards from the *Journal of Management Education* and the *Decision Sciences Journal of Innovative Education* and numerous conference best paper awards. His other research interests are in graduate management education and the intersection between spirituality and strategic management research. Ben also sits on the editorial boards of numerous journals, including the *International Journal of Management Reviews*, the *Decision Sciences*

Journal of Innovative Education, *Management Learning*, *The Internet and Higher Education*, the *Journal of Management, Spirituality, and Religion,* and the *Journal of Management Education*.

Robert M. Bernard is Professor of Education (Educational Technology) at Concordia University and Systematic Review Theme Leader for the Centre for the Study of Learning and Performance. His research interests include distance and online learning and instructional technology. His methodological expertise is in the areas of research design and statistics and meta-analysis.

Eugene Borokhovski is an Assistant Research Professor with the Department of Psychology and Systematic Reviews Project Manager at the Centre for the Study of Learning and Performance, Concordia University, Montreal. His research interests and area of expertise include cognitive and educational psychology, language acquisition and methodology of systematic reviews, meta-analyses, in particular.

Eva M. Bures is an associate professor in Education at Bishop's University and is a member of the Centre for the Study of Learning and Performance. A graduate of Reed College and Concordia University, her work focuses on knowledge tools that scaffold learners' development of higher-order thinking skills through computer-supported learning and assessment, both in distance and face-to-face contexts.

Ronald L. Carr is a doctoral student in Learning Design and Technology at Purdue University. He received his Bachelor's degree in Elementary Education and will soon receive his M.S. in Educational Studies, Gifted and Talented Education, from Purdue University. He is a research assistant Institute for P-12 Engineering Research and Learning (INSPIRE), where he works on assessments, curriculum development, in-service teacher training.

Martha Cleveland-Innes is Professor and Program Director in the Center for Distance Education at Athabasca University in Alberta, Canada. She teaches Research Methods and Leadership in the graduate programs of this department. Martha has received awards for her work on the student experience in online environments and holds a major research grant through the Canadian Social Sciences and Humanities Research Council. In 2009, she received the President's Award for Research and Scholarly Excellence from Athabasca University. Her work is well published in academic journals in North America and Europe. Current research interests are in the areas of leadership in open and distance higher education, teaching and learning in online higher education and the effects of emotion on learning.

Wellesley R. (Rob) Foshay is on the faculty of Walden University, and principal of The Foshay Group (www.foshay.org). His background includes experience as the chief instructional architect of the PLATO Learning System, faculty appointments at the University of Illinois—Champaign, Governors State University, and as a high school teacher and school technology coordinator. He directs education research for Texas Instruments' Education Technology Group. He has contributed over 70 major articles to research journals and books. In addition to coediting a handbook of Instructional Design in the *Handbook of Improving Performance in the Workplace* series published by Wylie/Pfeiffer and sponsored by ISPI, he is coauthor of the award-winning textbook, *Writing Training That Works: How to Teach Anyone to Do Anything*. His doctorate is in instructional design from Indiana University. He may be reached through his Web site at www.foshay.org, and directly at rfoshay@foshay.org.

D. Randy Garrison is the Director of the Teaching and Learning Centre and a professor in the Faculty of Education at the University of Calgary. Dr. Garrison has published extensively on teaching and learning in adult, higher and distance education contexts. He has authored or coauthored eight books and over 100 refereed articles/papers. His recent books are *Blended Learning in Higher Education* (2008); *An Introduction to Distance Education: Understanding Teaching and Learning in a New Era* (2010); and *E-Learning in the 21st century* (2nd ed.) (in press). He has also won several awards including the 2009 Sloan-C Award for Most Outstanding Achievement in Online Learning by an Individual.

Rajashi Ghosh is an Assistant Professor in the Human Resource Development program in Goodwin School of Education at Drexel University. Her research interests include mentoring, workplace incivility, and the implications of virtual collaboration for workplace learning. Prior to joining academics, Rajashi worked in the corporate sector in the areas of employee development and performance management. She completed her doctorate in Educational Leadership and Organizational Development with specialization in Human Resource Development (HRD) from University of Louisville. She received the 2010 Dissertation of the Year Award from the Workplace Learning Special Interest Group of American Educational Research Association (AERA). Also, she received the 2010 Best Paper in Management Development Award as recognized by the Management Education and Development division of the Academy of Management (AOM) for her paper on developmental networks and leader development.

Andrew S. Gibbons is currently a faculty member and chair of Instructional Psychology and Technology at Brigham Young University. Prior to that, he was a faculty member at Utah State University in Instructional Technology. For 18 years, he led instructional design projects in industry at Courseware Inc. and at Wicat Systems, Inc., including work on large-scale training development, design of simulations, and innovative forms of computer-based instruction. Dr. Gibbons' current research focuses on the architecture of instructional designs. He has published a design theory of Model-Centered Instruction, proposed a general Layering Theory of instructional designs, and is currently studying the use of design languages in relation to design layers as a means of creating instructional systems that are adaptive, generative, and scalable.

Stacey Greenwell is the Associate Dean for Academic Affairs and Research at the University of Kentucky Libraries. She is working on an EdD in instructional systems design at the University of Kentucky. She is interested in the effect of interactive classroom technologies on learning with a particular focus on library information literacy instruction. A frequent speaker at library and technology conferences, she is a recent graduate of the Frye Leadership Institute for higher education professionals.

Michael E. Griffiths a native of England, spent the first half of his career in the computer industry mainly in software development and IT management in Europe. Dr. Griffiths earned his doctorate in Instructional Psychology and Technology. His research centered on bringing into the domain of distance education the use of asynchronous video as a means of achieving the positive elements of human relationships that can exist in face-to-face classrooms. Michael is currently the Director of Online Learning at Brigham Young University–Hawaii where he has been implementing the use of asynchronous video in an online learning program that serves students from over 30 countries around the world.

France Henri has a Ph.D. degree in Educational Technology. She is professor at the Télé-université of Université du Québec à Montréal. She was founding member of LICEF Research Centre where she held the position of scientific director. As practitioner and researcher for some 20 years in the field of tele-learning, she has developed a solid background in pedagogical engineering and in the use of learning technologies. She was involved in the pan-Canadian LORNET Research Program as principal researcher where she leads a research team for the development of innovative pedagogical design practices based on Learning Objects. She participated in Kaleidoscope, a European NoE, as board member of the Virtual Doctoral School. Her main research interests include collaborative learning, pedagogical engineering of virtual learning environments as well as the pedagogical uses of computer mediated communication. She authored two books on distance education and collaborative learning, several book chapters, and over 50 scientific articles.

Brad Hokanson a professor in the College of Design at the University of Minnesota and serves as Associate Dean for Research and Outreach. He teaches in the areas of interactive media, critical thinking, and creative problem-solving. He won the College of Design's award for Outstanding Teaching in 2008. He has a diverse academic record, including degrees in art [Carleton], architecture [Minnesota], urban design [Harvard], and received his Ph.D. in Instructional Technology from the University of Minnesota.

His research focuses on creativity and design thinking. He has published his research in Computers in Human Behavior, Interactions with Media, Educational Technology, and the Handbook of Visual Languages in Instructional Design. He is a registered architect with a number of award winning projects, although no longer in active practice. Visits to Buenos Aires support his Argentine tango habit.

Sarah K. Howard is a Lecturer in Information and Communication Technologies in the Faculty of Education, University of Wollongong. Sarah's research focuses on technology-related school change within large-scale educational initiatives. Specifically, she looks at how teachers in different educational contexts understand technology integration in curriculum and teaching practice. Sarah is currently working with the New South Wales Department of Education and Training (NSW DET) to evaluate an Australian federal education initiative, the Digital Education Revolution, in secondary schools in New South Wales (2010–2013). In 2010, the evaluation collected survey responses from over 40,000 Year 9 students and 6,000 secondary school teachers across the state. Sarah works collaboratively with academics at the University of Cape Town and Rhodes University to study teachers' experiences in South Africa's federal Teacher Laptop Initiative. She has also worked with academics in the USA to conduct school-based research on technology integration in rural schools across multiple states.

Jason B. Huett is the Associate Dean of Online Development and a tenured Associate Professor at the *University of West Georgia*. He presents internationally on topics concerning distance education and online learning. He is a member of noted editorial boards and serves as a consultant for several virtual schools, universities, and the State of Georgia. He was a featured researcher at the 2006 *Association for Educational Communications and Technology (AECT)* International Convention in Dallas, Texas and has published numerous articles—including award-winning publications—in journals such as *The American Journal of Distance Education, Quarterly Review of Distance Education, The Information Systems Education Journal, International Journal of Instructional Technology and Distance Learning, Online Journal of Distance Learning Administration,* and *TechTrends.* He also has several book chapters in print, and this is his second book.

Jason is currently the Chairman of the Board of Directors for the *Virtual Learning Chapter* of AECT and the Contributing Editor for the *Journal of Applied Instruction Design*. He also cochaired the *2010 AECT Summer Research Symposium*. He recently designed a new online doctorate in School Improvement at the *University of West Georgia* which launched in summer 2011.

His other research interests include online communications, distance learner motivation, online collaborative learning, instructional design for online environments, standards for distance education, and K-12 online learning.

Jason lives with his wife, three children, and an overgrown clown of a Boxer pup in Carrollton, GA and can be reached at jhuett@gmail.com.

Philip Ice is the Director of Course Design, Research and Development at American Public University System (APUS) and Vice President of Research and Development for Sage Road Analytics, LLC. His research is focused on the impact of new and emerging technologies on cognition in online learning environments. Work in this area has brought him international recognition in the form of three Sloan-C Effective Practice of the Year Awards (2007, 2009, and 2010). Sloan-C has also recognized Philip through awarding a team he led at APUS with the Gomory Award for Data Driven Quality Improvement in 2009. He has been recognized by industry through membership in Adobe's Education Leaders Group and Adobe's Higher Education Advisory Board, as well as a recipient of the Adobe Higher Education Leaders Impact Award, 2010. His work has covered the use of technology mediated feedback, which has been adopted at over 50 institutions of higher education in five countries, multilevel institutional assessment techniques, and application of semantic analysis for mapping institutional learning assets. Philip has conducted over 100 peer reviewed and invited presentations and workshops, as well as authoring more than 20 articles, book chapters and white papers related to the integration of emerging technologies in eLearning.

Sharon A. Kerrick is an assistant professor at University of Louisville's College of Business in the Management and Entrepreneurship department for the past 6 years. Prior to joining University of Louisville, she was one of the founders of a technology business that grew to over 300 full time staff in five states and was in business for nearly 20 years. She holds a Masters in Human Resource Education in addition to her Ph.D. and leads the teaching of the award winning nationally ranked undergraduate entrepreneurship program here at University of Louisville. She is the recipient of several awards including: Business First's 40 Under 40 Leadership Award, Women 4 Women Champion 4 Her award and Junior Achievements Leadership award.

Wei Liu is a doctoral student in Learning Design and Technology at Purdue University. She received a B.S. in Educational Technology from Liaoning Normal University in China, an M.S. in Educational Technology from University of Central Missouri. She used to be a high school teacher and has been working with both preservice and in-service teachers. She is a research assistant to facilitate elementary engineering education through face-to-face and online teacher professional development in Institute for P-12 Engineering Research and Learning (INSPIRE).

Jennifer A. Maddrell is a doctoral student in the Old Dominion University Instructional Design and Technology program where she was a Graduate Research Assistant from 2008 to 2009. For over 15 years, Jennifer worked within leading global insurance companies and progressed through various underwriting and management positions after completing a Master of Business Administration degree from the University of Illinois at Chicago. In 2005, Jennifer began a career transition to pursue her passion for education and technology and in 2007 completed a Master of Science in Education degree at Indiana University in the Instructional Systems Technology program.

Jennifer was recently awarded the 2010 Mandell Award as outstanding student in Instructional Design and Technology within Old Dominion University's Darden College of Education, as well as a 2010–2011 dissertation fellowship to complete her doctoral dissertation which examines the relationship between learners' perceptions of community in a distance learning environment and learning outcomes. She has also explored instructional design methods and current technologies to support learning within various conference papers and presentations and has served as the Managing Editor of the *Journal of Computing in Higher Education* since July of 2008.

Olga Marino is Computer Scientist from the University of Los Andes in Colombia. She has a Ph.D. in Artificial Intelligence from the university Joseph Fourier in France. For more than 10 years, Mme Marino has been Professor of the School of Engineering at the University of Los Andes and director of the Laboratory on Technology Enhanced Learning, LIDIE, of this university. LIDIE was honored with the Colombian Simon Bolivar price and the Stockholm Challenge Price. Since 2002, Olga is Professor at the Tele-learning university, of the University of Quebec at Montreal, TELUQ-UQAM, and researcher of its research center on cognitive informatics and Learning Environments, LICEF. In 2005 Olga Marino won the Price of the Minister of Education of Quebec; she is member of the Excellence Circle of the University of Quebec since 2006. Her research interests include technology enhanced learning, e-learning environments, knowledge management, representation and reasoning as well as personalization and recommender systems.

Jonathan O. McKeown is currently an Assistant Professor of Instructional Design and Technology at the University of Tampa. His current research areas include assessing complex and ill-structured problem-solving, developing advanced representations of mental models, integrating systems thinking into the classroom through modeling and simulation, and examining the use of technology in the classroom to facilitate complex problem-solving and learning.

Prior to his current appointment Jonathan was a researcher at the Learning Systems Institute at Florida State University working primarily on a Department of Education Comprehensive School Reform grant.

Leslie Moller is a graduate of Purdue University's Instructional Research and Development program. He is a Professor of Educational Technology for Walden University, the former Chair of the Technology for Education and Training Division at the University of South Dakota and former Coordinator of the Instructional Systems Program at Penn State University in Great Valley.

Leslie is the former cochair of two Association for Educational Communications and Technology (AECT) Research Symposia and editor of the Journal of Applied Instructional Design (JAID). He also serves on the editorial boards of the Quarterly Review of Distance Education, International Journal of Educational Technology and Performance Improvement Quarterly. Dr. Moller is also the former chair of the Instructional Technology Special Interest Group within the American Educational Research Association as well as the Distance Education and Curriculum committees for AECT. Leslie has authored over three-dozen articles and book chapters related to Distance Education and Instructional Systems Design. Dr. Moller has over 25 years of experience consulting with corporations, governments, and nonprofits regarding learning and performance.

He and his wife Mary Ann, and two dogs, two cats, and a pond full of KOI fish, live in Yankton, South Dakota, alongside the Missouri River.

He can be easily reached at lesmoller@aol.com or on Skype: *Lesmoller.*

Gary R. Morrison received his doctorate in Instructional Systems Technology from Indiana University and is a professor and graduate program director in the instructional design and technology program at Old Dominion University. His research focuses on cognitive load theory, instructional strategies, K-12 technology integration, and distance education. He is author of two books: Morrison, Ross, and Kemp's *Designing Effective Instruction* (6th ed.) and Morrison and Lowther's *Integrating Computer Technology into the Classroom* (4th ed.). He has written over 25 book chapters and over 40 articles on instructional design and educational technology. Gary is the editor of the *Journal of Computing in Higher Education* and is on the editorial boards of *Computers in Human Behavior, Quarterly Review of*

Distance Education, and Libraries Unlimited's *Instructional Technology Serie*s. He has worked as instructional designer for three Fortune 500 companies and the University of Mid-America. Two of the distance education courses he designed were accepted for broadcast on PBS and NPR. Gary is a past president of Association for Educational Communication and Technology's (AECT) Research and Theory Division and Design, Development Division, and Distance Learning Division.

Jennifer R. Morrison is a full-time student working on her Ph.D. in instructional design and technology at Old Dominion University. She works as a graduate research assistant in the Cognitive Learning Lab at Virginia Modeling, Analysis, and Simulation Center of Old Dominion University. Her primary research focus is on message design and the influences of cognition and perception on design.

Debbie Denise Reese is the principal investigator for CyGaMEs, a project funded through the National Science Foundation's REESE program. CyGaMEs stands for Cyberlearning through Game-based, Metaphor Enhanced Learning Objects (http://cygames.cet.edu). CyGaMEs studies instructional design, learning, and assessment using game-based technologies. Reese invented the CyGaMEs approach to instructional game design and assessment. CyGaMEs readies learners for academic success by translating challenging science concepts (what scientists *think)* into engaging gameplay (what learners *do*). This makes learning more intuitive. At the same time, the CyGaMEs environment tracks each student's gameplay to assess learning and perceived experience (flow). CyGaMEs created the award-winning instructional environment *Selene: A Lunar Construction GaME* (http://selene.cet.edu). *Selene* players learn the fundamental geological concepts as they form the Earth's Moon and then pepper it with impact craters and flood it with lava flows.

Reese is the senior educational researcher at the Center for Educational Technologies® and NASA-sponsored Classroom of the Future at Wheeling Jesuit University in Wheeling, WV. Reese developed the CyGaMEs approach as lead Classroom of the Future™ researcher and project manager supporting NASA eEducation's initiative to study learning and assessment within game-based environments. An instructional theorist, Reese applies cognitive science to the design of learning environments and educational technology tools. The CyGaMEs method applies cognitive science metaphor theory (structure mapping) toward design of instructional environments that prepare students to learn complex science concepts.

Reese has led Classroom of the Future design and research teams in development and study of technology tools for enhancing self-efficacy, identity, and argumentation. She conducts evaluations and needs assessments. She is part of the Classroom of the Future team producing the virtual world *MoonWorld* (http://moonworld.cet.edu), an educational simulation for authentic lunar science fieldwork. *MoonWorld* opened in the Second Life virtual world in October 2009. *MoonWorld*'s release in OpenSim for youth ages 9 and up is scheduled for December 2010.

Jennifer C. Richardson is an Associate professor of Learning Design and Technology at Purdue University. She is currently the Co-PI on a USDOE FIPSE grant that examines the use of peer feedback in online discussions, Co-PI on a

USDA funded project that centers on the Military Partnership Outreach Project, and PI on a funded project that examines the impact of educational videos as a supplement to sixth grade science curriculum on students' views of the nature of science (VNOS) and their content knowledge. Jennifer has been the recipient of *Sloan-C Effective Practices in Online Education Award* for "Using the Community of Inquiry Framework Survey for Multi-Level Institutional Evaluation and Continuous Quality Improvement" (2009) as well as the *Excellence in Distance Teaching Award* and the *Discovery Award for Scholarship of Teaching* at Purdue University. Her research interests include best practices in distance education, especially as it relates to sociocognitive aspects of learning and measuring learning in online environments.

Don Robison is a Ph.D. student at Old Dominion University. He has been a practicing instructional designer and performance technologist for over 25 years. His experience as a designer has ranged from one to one training programs for mentally disabled individuals to enterprise e-Learning in federal agencies. Don led the Web training implementation group for the Coast Guard for several years, and has served on federal distance learning and performance technology working groups. His research interests are learner motivation, instructional simulation, distance learning, and task analysis. He can be reached at don.robison@cox.net or drobi036@odu.edu.

Carolyn Rude-Parkins held instructional, leadership and management positions during a 30 year career at University of Louisville. She conducted courses in Human Resource Education on campus, via distance delivery and at branch campuses including four international sites. She developed and taught courses for instructional designers and trainers in business, government, and military sectors. She secured and managed contracts totaling more than two million dollars. Her research and publications focus on instructional technology applications and workforce development.

Richard A. Schwier is a Professor of Educational Technology and Design (ETAD) in the College of Education, University of Saskatchewan. He teaches in the ETAD graduate program and is the principal investigator in the Virtual Learning Communities Research Laboratory (http://vlcresearch.ca), and recently completed a stint as the Acting Director of the University Learning Centre. His research interests include social agency and culture in instructional design, and the mysteries of engagement in online learning environments. A central premise of this work is that instructional design has much to learn from informal social networks and how learners construct personal learning environments out of the array of social resources available online.

At the University of Saskatchewan, Richard is working with colleagues to reinvent their approach to teaching instructional design. One deep challenge is how to construct authentic learning environments with groups of online and resident students, so addressing and inventing new e-learning designs is high on the ETAD agenda.

MaryFriend Shepard is a professor and the Specialization Coordinator of the Educational Technology Ph.D. program at Walden University where she mentors doctoral students, teaches online courses, and mentors dissertation studies in educational technology, along with the administrative duties of directing the educational technology Ph.D. program. She has been in education for over 35 years, working in public schools, conducting teacher workshops, and teaching in schools of education at the University of Cincinnati, Indiana University, Florida State University, and Thomas University, before moving to Walden University.

Her love is the integration of technology in K-12 schools, and the transformation of online/distance education. Her current research is exploring means of establishing a culture of digital collaboration in online communities, and the power of electronic portfolios (e-folios) as a tool for student reflection in teacher education programs. She conducts teacher workshops in the areas of educational technology, critical thinking, cooperative learning, differentiated instruction, ADHD and other sensory disabilities, and other areas of interest to teachers. She has authored numerous articles on technology, critical thinking, and ADHD.

J. Michael Spector is Professor of Educational Psychology and Instructional Technology and current chair of Learning Technologies in the College of Information at the University of North Texas. Recently, he was the Doctoral Program Coordinator for the Learning, Design, and Technology Program, Research Scientist at the Learning and Performance Support Laboratory, and Interim Codirector of the Program Evaluation Group at the University of Georgia. He was Associate Director of the Learning Systems Institute, Professor of Instructional Systems, and Principal Investigator for the International Center for Learning, Education and Performance Systems at Florida State University (2004–2008) prior to his move to UGA in January 2009. He was Chair of Instructional Design, Development and Evaluation at Syracuse University (2000–2004) and Director of the Educational Information Science and Technology Research Program at the University of Bergen (1996–1999). He is a distinguished graduate of the US Air Force Academy and earned a Ph.D. in Philosophy from The University of Texas at Austin (1978). His recent research is in the areas of intelligent support for instructional design, system dynamics based learning environments, assessing learning in complex domains, distance learning, and technology integration in education. Dr. Spector served on the International Board of Standards for Training, Performance, and Instruction (*ibstpi*) as Executive Vice President; he is on the Executive Committee of the IEEE Technical Committee for Learning Technology and is the Past-President of the Association for Educational and Communications Technology (AECT). He is the editor of the Development Section of *Educational Technology Research and Development* and serves on numerous other editorial boards. He coedited the third edition of the *Handbook of Research on Educational Communications and Technology*, is again lead editor on the fourth edition, and has more than 100 journal articles, book chapters and books to his credit.

Johannes Strobel is director of Institute for P-12 Engineering Research and Learning (INSPIRE), assistant professor of Engineering Education and Learning Design and Technology. He received his BPh (Philosophy) at Munich School of Philosophy, his B.S. (Information Science) and B.A. (Religious Studies) at Saarland University, Germany, and his M.Ed. and Ph.D. in Information Science and Learning

Technologies at the University of Missouri. His research interests include "Teachable moments" of engineering education, reverse engineering of engineering education, "engineering in the wild" for teaching/learning engineering design and problem-solving, and engineering as a caring discipline.

Karen P. Swan is the Stukel Professor of Educational Technology and a Research Associate in the Center for Online Learning, Research and Teaching at UIS. Dr. Swan's research has been focused mainly in the general area of electronic media and learning. She has authored over 90 journal articles and book chapters, produced several hypermedia programs, and coedited two books on educational technology topics. Her current research interests include online learning, ubiquitous computing, and data literacy. Dr. Swan was the 2006 winner of the Sloan-C Award for Most Outstanding Achievement in Online Learning by an Individual, and a member of the inaugural class of Sloan-C Fellows.

Rana M. Tamim is Director of Graduate Programs, and Associate Professor in the School of e-Education at HBMeU. She is a collaborator with the *Centre for the Study of Learning and Performance*, Montreal, Canada. Her research expertise includes quantitative and qualitative skills in addition to systematic review and meta-analytic expertise. Her research interests include the impact and role of computer technologies in facilitating learning.

Ginger S. Watson is an Associate Professor in the Department of Science, Technology, Engineering, and Mathematics Education (STEM) and Professional Studies in the Darden College of Education with a joint appointment at the Virginia Modeling, Analysis, and Simulation Center (VMASC) at Old Dominion University. She completed her Ph.D. at the University of Iowa in 1998 during which she received a number of awards including a Link Foundation Fellowship in Advanced Simulation and Training.

Dr. Watson has 20 years experience in simulator and immersive environment research and development, including 15 years in senior and chief scientist positions. Her research interests include performance, cognition, and learning in distance education, simulation, gaming, and virtual environments. The backbone of this research is the use of measures to assess attention, immersion, and cognitive processing. During her career, she has secured over 60 funded research projects. She is the author of over 60 publications and serves as an associate editor of the *Journal of Computing in Higher Education*.

Rémi Wognin (rewognin@yahoo.ca) is a Ph.D. candidate in Cognitive Computer Science at the Université du Québec à Montréal—TELUQ. He has a Master (M.Sc.) degree in Computer Science from the Université Pierre et Marie Curie Paris 6 (France). His main research interests are: distributed cognitive architecture, multiagent systems, knowledge management, distributed learning, and e-learning. Additionally, Rémi is an IT professional with many years of experience; he is currently working as an IT project manager at University of Montreal (Canada).

Unconstrained Learning: Principles for the Next Generation of Distance Education

Leslie Moller, Don Robison, and Jason B. Huett

Consider this: distance education programs, like fast food products, often seem to be built to the lowest common denominator. They fatten the mind with packaging and promised convenience but offer little intellectual nutrition and provide few positive effects other than the illusion of being satisfied.

Like any boon, the exploding need for education and training at a distance has created a fertile ground for snake-oil salesmen and hucksters who favor style over substance and profit above all else. This has led to a marketplace where distance education neither capitalizes on what we clearly know in terms of teaching and learning nor does it take advantage of the broad capabilities of readily available technology. In other words, distance education's biggest sin may not be what it currently does, but what it does *not* do.

This chapter outlines a new paradigm for the next generation of distance learning and highlights ten principles to help move us forward toward the goal of unconstrained learning.

> Without deviation progress is not possible (Frank Zappa).

There can be no real question that distance learning has arrived on the educational scene with force and impact. It is true that, for many decades, there have existed limited and effective distance education programs servicing learners in remote locations. However, as recently as a few years ago, distance education was generally regarded as a stepchild to the dominant classroom model or as an oxymoron regulated to an unsavory image of questionable correspondence or for-profit

L. Moller, Ph.D (✉)
Walden University, Minneapolis, MN, USA
e-mail: Lesmoller@aol.com

D. Robison, M.S
Old Dominion University, Norfolk, VA, USA

J.B. Huett, Ph.D
University of West Georgia, Carrollton, GA, USA

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Table 1 Three generations of distance education

Generation	Chief characteristics
First generation distance education	Correspondence courses
Second generation distance education	Internet-based courses, discussion, chat
Third generation distance education	Technology-enabled learning environments

schools. Today, distance education has become an irresistible force in mainstream education and training environments. Distance education, once considered a last option for learners, is now a viable opportunity for educational providers in practically every learning context. Distance education has made learning accessible to many hundreds of thousands of people who otherwise would have been denied an educational opportunity.

As both learners and distance education providers have come to see the potential of this delivery medium, the demand for distance education has grown dramatically. This high demand has allowed some providers to become complacent, and many seem satisfied with the status quo. Part of this satisfaction is understandable since distance education providers are enabling learning in new ways to potentially large populations of students. In many cases, this has resulted in a hastily configured classroom-adapted-to-the-web approach that bypasses known principles of learning and teaching and makes little use of technology affordances in an intelligent or creative fashion. In being satisfied with this approach, these providers are missing out on one of the great educational opportunities in history and shortchanging their audience.

It is time to use the known principles that guide effective practice to design and deliver distance learning. It is time to envision, and advance toward, a new learning landscape unconstrained by time and space. It is time to harness the power of the next generation of distance education.

> Every generation needs a new revolution (Thomas Jefferson).

The three generations of distance education may be represented as correspondence courses (the first generation), internet-based courses (the second generation), and courses offered in the technology-enabled space (the newest and third generation). In the second generation, the advent of the internet allowed ubiquitous instruction that largely capitalized on the affordances of text, file sharing, and rudimentary learning management systems. The third generation expands on these affordances and exploits the multitude of interactive, participative, simulation, visualization, gaming, modeling, and discovery technologies now available. The third generation of distance education is to the second generation as cloud computing is to a single local computer. The concept is similar, but the application is so much broader that a clear distinction must be made. Table 1 describes the three generations of distance education.

Our hypothesis presupposes that we have reached a critical point in innovation adoption where education practice will be dramatically altered. Older correspondence-style methods of instructional delivery are limited in terms of educational achievements, and classroom-adapted-to-the-web approaches to learning

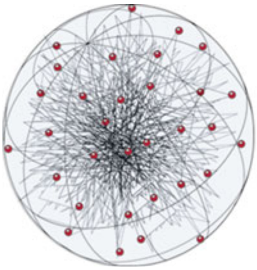

Fig. 1 The technology-enabled learning space

are often ineffective and do little to harness the transformational potential of technology. E-learning scenarios, ubiquitous technologies, communication and information access, simulation, gaming, and personal learning environments (that were unthinkable just a few years ago) are becoming mainstream. The result is that the main driver for the learning process is shifting from instructor-centered approaches to carefully designed learner experiences with robust interactions between learners and content.

A world of learning and experience lies ahead that will employ what we know about human learning, instructional strategies, and evidence-driven practice, as well as tap into the transformational power and potential of technology. We are not being led by technology in this, but we cannot ignore the aggregate impact of decades of break-through technological advances and the trend toward openness, ubiquitous access, and collaboration as well as a renewed vision of learning as experience. All of these are coming together to empower the next generation of learners. It is time to look into the fog and chart the way ahead.

The distance learning process, often constrained to modest point-to-point connections between learner and instruction, is beginning to be replaced by the growing realization that distance education is a learning experience that takes place in a *technology-enabled learning environment* that has dimension: volume, depth, and breadth.

First, the technology-enabled space has *volume*, that is, there has been a dramatic increase in the number of communications connections/options available to the learner. Second, this space has *depth*, meaning each of these new communications connections/options has improved capacity for data transmission, reliability, length, and size. Third, this space boasts a *breadth* of potential experience that is practically limitless.

Because it is adaptable, Bomsdorf (2005) describes this space as having a kind of plasticity. It constantly flexes to changing needs, new technologies, and new ideas for employing existing technologies. Learners may participate in a number of activities including class discussions, online group workspaces, and simulations or learning games. Digital devices and mobile technologies like smart phones, iPads, and global positioning systems (GPS) extend the options for the distance experience. In addition, productivity, visualization, and presentation software allow learners to synthesize and to present findings with high levels of quality (Fig. 1).

Rather than viewing distance as a barrier to overcome, we view the *space* as a unique opportunity to exploit the power of the cognitive processes of knowledge building in conjunction with technology.

Furthermore, the learning needs of students at all levels, as well as the expectations of the global marketplace, have evolved to the point where memorization, well-structured problem solving, and mastery of information are no longer satisfactory outcomes. Students need to be able to solve real-life problems in a digitally saturated world. This type of rote learning does not match the realities of the world in which the students find themselves, and as secretary of education, Dr. Rod Paige, noted in his introduction to the *Visions 2020 Report*:

> Schools remain unchanged for the most part despite numerous reforms and increased investments in computers and networks. The way we organize schools and provide instruction is essentially the same as it was when our Founding Fathers went to school. Put another way, we still educate our students based on an agricultural timetable, in an industrial setting, but tell students they live in a digital age (US Department of Education 2005, p. 22).

> We drive forward with our eyes firmly fixed on the rear view mirror (Marshall McCluhan).

The explosive growth in distance education over the last 10 years is good news in many ways. Obviously, it is a strong indication that distance education is enabling students to receive the educational opportunities they desire and that may not otherwise be available. The growth in distance education also allows corporations to provide training, often at lower cost, while simplifying the travel schedule of its employees. This is good news, right?

The answer is actually more complex than it may initially seem. First, distance education grew out of the correspondence school movement, and little attention was paid to it until the internet was adopted and widely accepted. Suddenly, seeing the opportunities, many rushed to develop and to deliver education to learners at a distance. We believe the primary driving force was market share and revenue—not educating students. In the rush to capitalize on this new and growing market, designers and developers used the familiar classroom model as the "ideal" and attempted to emulate it at a distance. In fact, many educational institutions still laud their virtual classes as being just like their traditional face-to-face courses.

It is not surprising that distance education pioneers replicated the known classroom and transferred their established paradigms to technology-enabled environments. This is a repeated pattern in technology adoption. In the face of dramatic innovation, people tend to move toward using familiar ways of operating, even though the new technology provides affordances for radically different approaches.

Early television pioneers took the familiar, namely radio, and attempted to replicate radio shows on TV, with stunning failure. As it relates to distance education, we would argue that the classroom model, with all its weaknesses, was not an ideal model or exemplar in the first place, and the ill fit has been made worse by ignoring the affordances of the new delivery medium.

Modern schools were developed and influenced by the industrialization of America. The idea was, if processes are sufficiently well designed, schools could run like factories and mass-produce educated students. This perspective was built upon the assumption that learning was a product—something to be *delivered*. Proponents of this position conceived of learning as an object that could be transferred.

With all manufacturing systems, there are inputs and outputs. In this case, the input (the uneducated student) was transformed in a precise, measurable, and uniform manner before exiting the assembly line as the output (the educated graduate). Of course, the quality of the output has been the subject of great debate, particularly in the last few decades. Regardless, the core value of the outputted student has consistently been described in terms of the student's possession of facts.

> It is possible to store the mind with a million facts and still be entirely uneducated (Alec Bourne).

One of the most well-known attempts at improving schools was the notion of high-stakes testing. While high-stakes testing has great political appeal and seems to be well received by many who are not professional educators, it is quite possible that such an approach has done more harm than good. The type of testing basically compares one group to an average. While comparison can be a good thing, in this particular case, it amounted to comparing learner proficiency (often with irrelevant pieces of information) and portraying it as meaningful. In other words, learning standards, in and of themselves, are not a bad thing; however, these standards, based largely on declarative knowledge of arguable import, do not make for a solid foundation of school reform and actually tell us very little about student learning. Real learning involves more than the ability to choose the correct answer on a standardized test. What we end up with is a system where teachers are forced to devote their limited time, energy, and resources to only teaching content measured on standardized exams.

Reich (1992), former secretary of labor elaborates on our current educational system in a harsh but accurate manner:

> [In the current classroom model] Children [move] from grade to grade through a preplanned sequence of standard subjects, as if on factory conveyor belts. At each stage, certain facts [are] poured into their heads. Children with the greatest capacity to absorb the facts, and with the most submissive demeanor, [are] placed on a rapid track through the sequence; those with the least capacity for fact retention and self-discipline, on the slowest. Most children [end] up on a conveyor belt of medium speed. Standardized tests [are] routinely administered at certain checkpoints in order to measure how many of the facts [have] stuck in the small heads, and product defects [are] taken off the line and returned for retooling. As in the mass-production system, discipline and order [are] emphasized above all else. (p. 60)

To be fair, schools and training environments also have other agendas and missions, and simply pointing out the inherent flaws in the factory model of education is an oversimplification of a very complex issue. There are issues of funding, political agendas, socioeconomic status, and accountability of parents, students, and teachers to name only a few. It is also important to point out that we are in no way castigating teachers or casting aspersions on their profound and positive impact on learners and learning. The current educational system survives on the backs of good, dedicated, teachers who do their very best to function within a complex but flawed educational system. However, there is only so much teachers can realistically do. To quote Rummler (2007), "Put a good performer in a bad system, and the system will win every time" (p. xiii). Teachers are the bedrock of our current educational practice, but it is past time to support them with dynamic learning experiences that take full advantage of the inherent power of the technology-enabled space because the traditional classroom, regardless of the nature of the learner or the issues within the system, presents limitations that the technology-enabled space does not.

I learn by going where I have to go (Theodore Roethke).

The vast array of available technology opens up a world free of constraints in time or space where new paradigms and new experiences in learning design can emerge. Consider a hypothetical geology course offered to students from various nations. Initially, students could meet for an asynchronous discussion, or perhaps, for a synchronous video conference to discuss an activity or assignment. Next, teams of students armed with cameras, smart phones with GPS receivers, digital thermometers, and other diagnostic equipment could travel into the field and explore various types of rock formations. They could share their findings and images in real time with the group and discuss the implications. They could accurately map locations and altitudes to develop patterns. Later, using a simulation layer in a Google Earth application, they could manipulate virtual 3D rocks and compare them to their samples. They could then use the technology to generate dynamic, high-quality, and even interactive reports. In other words, the proliferation of computerized and web-enabled tools, mobile devices, and powerful software has combined to create a multidimensional learning space. We only have to discover how to optimally leverage this space to its fullest potential.

This is not an argument for resuming media comparison studies; rather, it is the presentation of a construct that helps define the field for the next generation of distance education. We will be designing for this environment, and it is important that we understand it and define the techniques, methods, and processes to explore what is truly possible in this learning space. We require a new paradigm.

In *PeopleWare*, DeMarco and Lister (1987) argue that "development is inherently different than production. But managers of development and allied efforts often allow their thinking to be shaded by a management philosophy derived entirely from a production environment" (p. 7). Sadly, educational leaders also adopt a production mentality focused on getting the "many" through the process. This perspective was a better match for a mass-production society where challenges were more routine. In comparison, today's workforce requires the ability to think creatively, flexibly, strategically, and to solve ill-defined problems. The next generation of distance education must assist learners in successfully meeting and overcoming the difficult challenges of modern life and work.

We know that learning is a product of experience and should not be viewed as something that is simply transferred from teacher to student. Rather, learning is a process that views knowledge as something which is built and made meaningful by the learner. To paraphrase noted scholar Jonassen (2006), no student intentionally leaves school to take tests. Rather, they should leave prepared to apply their skills and knowledge to real, ill-structured problems and issues that require critical understanding and, often, unique answers. They should leave school ready to solve the problems of *life*.

The dilemma is that our existing educational models, especially those found in distance education, do not optimally use the available technology or the range of proven learning designs to create the kinds of learning experiences that equip students for contemporary challenges. The paradigm of learning as a product that promotes memorization of questionable facts of limited import, such as those measured by high-stakes testing, is not just a bad idea, it is ultimately corrosive. As we invest resources in this approach, those same assets are drawn away from where they would do the most good: the development of rich learning experiences based on proven instructional strategies enabled by unprecedented technological capability.

The last decade has been a rich time of growth for distance education, both in terms of process and technologies, but it is time to move into the next generation. What we offer here are ten guiding principles for the *Next Generation of Distance Education*. These are presented as the beginning of a broad philosophy to help shape and guide the future of technology-enabled learning at a distance.

> The idea is there, locked inside, and all you have to do is remove the excess stone (Michelangelo).

Ten Guiding Principles for the Next Generation of Distance Education

1. **Effective distance learning is based in sound instructional strategies and is not information presentation.**
   Learning happens all the time; we learn things that people tell us, or we can learn by watching or by experimentation. Every experience is a learning experience, and they are not created equally. They all compete for attention and mindshare, and the most resonant experiences win (Shedroff 2001). Learning is not just information presentation; it is experience and the reflection that comes from it. What does this mean practically? It means that those who design and deliver distance education may need to see themselves more as learning experience designers than as information transmission specialists. There is a growing need for instructional designs and models based on sound learning theory and research. We need to use evidence-based instructional strategies.

   Distance education, with slight variation, is generally defined as a method where the teacher and student, separated by space and/or time, use technology to communicate. In this definition, distance education may be perceived as a medium rather than an instructional strategy. This is one reason some distance educators chose the replicate classroom model; they needed to fill a vision void. What we are proposing is that distance education needs to evolve to a learning model that is primarily engaged in the development of the learner (and the learning experience) using sound instructional strategies. These strategies must be developed, first with the articulation of clear learning objectives, and then with an eye to the affordances of available technology.

In the next generation of distance learning, rather than seeing distance as a barrier to overcome, we argue it should be viewed as an opportunity to emphasize the cognitive processes of knowledge building, meaning making, collaboration, and problem solving. The focus will be on interaction and instruction which prepares learners to solve ill-structured problems through transformative or generative processes. Rittel and Webber (1973) called these ill-structured problems "wicked" because they defy easy solution and formulaic approaches seldom work with them. Such problems characterize our age. Learners require problem-solving skills more than they require pat answers. Such transformative or generative processes focus on creativity, collaboration, argumentation, and dialogue directed at solving complex problems and providing lifelong, continuous learning (Preskill and Torres 2000).

Our argument is that while most traditional instruction is effective in controlling and managing the educational experience, it does not optimize, and may even inhibit, key human learning abilities (Marshall 1997). While traditional instruction supports individual pursuit of objective and well-defined learning, it appears to be incompatible with the more disorganized collaborative and dialogue-based learning models which are well suited for distance learning (Bonk and King 1998). In the next generation distance learning environment, technology expands from simply carrying information or instruction to being a platform for expanding cognitive capabilities as well as being a context or laboratory for manipulating the learner's internal and external environments.

Multilevel feedback supports the learning process. Evaluation will be focused on the student's analysis of information, synthesis of ideas, and formulation of cohesive arguments. Sometimes, getting the right answer is important, but ultimately, skillfully and logically processing the aspects of a challenge and successfully meeting it are more important. In other words, a learner who gets it wrong and understands why is often better off, from a learning perspective, than the student who gets it right, but cannot explain how or why.

The components of the next generation of distance learning will be neither sequential nor discrete: they will be interconnected, dynamic, and often overlapping. What makes a particular learning experience effective is not one particular component, but rather the idea that all of the components are used in concert with the learner's individual context to create a rich and relevant context.

2. **Technology has expanded from a mere delivery system to an environment facilitator that enables dynamic human interactivity.**
   Technology now creates a 3D learning space (see Fig. 2), and it may serve to think of technology as an environment facilitator. As we seek to optimally use this environment to accomplish learning objectives, the instructor or instructional designer must make decisions regarding how to use technology to achieve specific learning outcomes. Morrison and Lowther's (2010) *NTeQ Model*, designed for integrating computer technology into K-12 classrooms, is a good

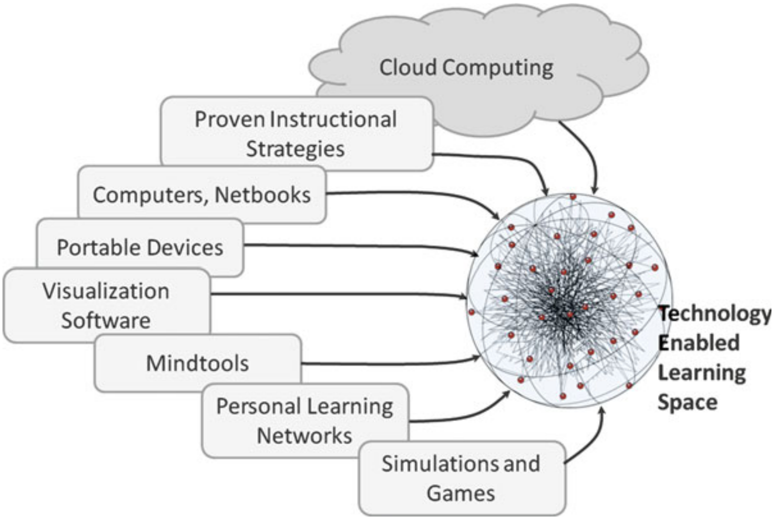

Fig. 2 The components of the technology-enabled learning space

practical example of the type of instructional design process needed for next generation learning. It is a learning-centric model that places technology use in a key place in the design process. Their model first identifies learning objectives and then matches appropriate technology functions to the learning strategies to meet those objectives. In the same way, distance instructors or learning designers can identify learning objectives for the distance learning experience and then draw on available web and computer technologies to support that experience.

Ranging along a continuum from static to dynamic, the options and combinations of instructional strategies and applicable technologies are virtually endless. Examples at the static end of the continuum are podcasts, web videos, webpages, and text. While these can be appropriately deployed in the learning environment, they do little to assist learners to build their own knowledge. Static technologies allow learners to capture or view stable information.

Examples in the middle of the continuum include technologies like wikis, blogs, and discussion boards. These approaches allow learners to interact with the content and each other and permit learners to evaluate and react to what others are contributing. They can compare ideas with existing knowledge representations and then synthesize and construct responses. New knowledge may be created through analysis and argumentation.

The dynamic end of the interactivity continuum includes tools and strategies that bring learners deeper into cognitive challenge. Tools used at this end of the spectrum include simulations and gaming, multiuser environments, and *Mindtools* (Jonassen 2006; Jonassen et al. 2008). The dynamic end of the continuum promotes questioning, investigation, experimentation, modeling, visualizing, reasoning, deliberating, designing, challenging, connecting, and problem solving.

3. **The next generation of distance education will be characterized by sophisticated strategies for socially connecting learners with each other and with instructors.**

People want to connect and to be part of a community. The phenomenal success of sites like *Facebook*, *Twitter*, and *Match.Com* testify to this. As we begin to understand how we can use technology to facilitate deeper and more satisfying personal connections, we will begin to incorporate these principles into distance learning design. In a recent needs assessment focus group at a small east coast university, we were struck to learn that 100% of the students were active participants in either *Facebook* or *Twitter*. The students felt that *Facebook* provided a great model for what technology-enabled social networking could be in an educational setting. They noted that *Facebook* allowed users a permanent presence in virtual space, unlike most school-related social presence efforts which were generally add-on features to a course for a semester. The more permanent presence, they argued, more closely approximated real-life patterns of social presence and availability and aided in creating a viable social space.

Technology can play a key role in connecting people. A quick look at the magnitude of popularity of some of the leading social networking websites confirms this. In 2011, *Facebook* reported over 500 million users worldwide, with over 150 million users logging on daily. *Match.Com* has reported that subscribers go on over six million dates annually. The number of active users of *Twitter* ranges from a very conservative 56 million to over 175 million registered users (Carlson 2011). The point being, technologically enabled social networking is hugely popular, and this popularity speaks to the desire of people to connect with others. The next generation of distance education must facilitate this type of connection in ways that draw on the relevant and replicable strengths of these successful social networking sites.

4. **The momentum toward enhancing social presence and encouraging higher-level cognitive processing will result in a conscious shift from cooperative toward collaborative learning.**

Cooperation can be defined as a group of people working together to achieve a common objective. People generally work on different pieces of a larger project so that, collectively, they may achieve more than they could individually. Cooperation requires a degree of planning, communicating, and understanding of a shared goal. For example, after winter snows melt, some riverfront towns experience flooding. Residents may cooperate to build a large sandbag wall, to protect the town from flooding, of a size and scope that none could have constructed individually. The key distinction in this example is that each person does a clearly defined part of the task: one may gather sand and bags while another person fills bags and still another transports them while another stacks, etc. They are not necessarily working collaboratively; rather, they are cooperating toward a mutually beneficial end with each doing his or her unique part.

Collaboration is different. With collaboration, the pieces or tasks are not as clearly delineated or disengaged from other parts. Participants work with each other to accomplish each step. Rather than dividing up the work and everyone doing a part, tasks are performed together. Collaboration is the combined effort of every participant to work together on all aspects of the problem. Each individual proposes ideas at every step of the process, argues to support his/her ideas, analyzes what others are saying, and works toward building a consensus until the group has arrived at an agreed upon course of action.

In the context of learning, true collaboration is much more chaotic and less efficient than cooperation, and often, collaboration creates more work for the individual student and teacher. But, the learning outcome from a collaborative problem-solving context is much deeper and more robust.

Together, we can accomplish more and learn more than we can alone. The problems of life (and of learning) are ill-defined and require our combined intellectual resources to solve them. Consider the challenge of returning the damaged *Apollo 13* spacecraft to Earth after its catastrophic failure. The work could have been divided in a piecemeal fashion, and some of it was, but the critical and most difficult parts of the task of saving the crew of *Apollo 13* fell to teams of specialists. Working together, they collaboratively rose to the challenge, did what many thought impossible, and safely returned the crew to Earth. What was true at *NASA* then is true in learning now: the best solutions are most often collaborative solutions. The next generation of distance education will emphasize collaboration over cooperation. It will be characterized by learners working together to process information and construct meaning. Cooperative processes will give way to collaborative processes.

5. **Distance learners will take greater responsibility for managing their own learning and demand that distance education technologies and providers enable and serve their learning priorities.**

Shepard (2011), in her chapter in this book, observed that learners are already actively creating personal learning networks. These networks include all the tools at the learner's disposal to solve their life challenges, and these networks currently operate best outside of the school environment. If a student has a question, he or she pulls out a smart phone and finds the answer instantly. Ubiquitous and immediate access to facts and other information has created a new learning dynamic that puts tremendous pressure on schools to shift from providers of information to institutions that promote critical thinking and decisive use of information. This means big change.

Shepard cited *Project Tomorrow's Speak—Up 2009* report (Project Tomorrow 2010) that students were demanding "social-based learning, untethered learning, and digitally-rich learning" (p. 1). Essentially, students were demanding that schools employ the effective tools for social learning and problem solving that the students already use in their personal lives. Students also want learning that is not bound by the classroom; they want technology to drive learning productivity on *their* terms.

Huett et al. (2010) discuss how control of the learning process is shifting more and more to the individual and that demands for more personalized learner-centered instruction, empowered learning, and technology-enhanced learning opportunities are causing a rethinking of the entire educational institution setup. In short, a new generation of learners is demanding new ways to learn.

The next generation of distance education must optimally employ ubiquitous new technologies and provide untethered connectivity to learning. Students are demanding that we use technology as creatively as possible to enable them to meet their learning needs and desires. We need to respond energetically and effectively to these concerns or risk obsolescence.

6. **The next generation of distance education will focus on the processes of learning, including creative application of the affordances of technology.** We believe the idea of learning design is one that has merit as a governing paradigm. The next generation distance education will treat learning outcomes as the result of experiences that may or may not include direct instruction. It will seek to stimulate and to develop higher-order cognitive processing. Examples of this approach are simulations and games, computing cloud experiences, and Jonassen's *Mindtool* use.

We have argued that active and constructive learning experiences are powerful. The practical implication in education is to employ learning experiences like simulations, modeling, gaming, and role-playing to accomplish learning objectives. For example, coast guard officers are trained in the complex skill of handling ships using formal classroom lecture methods, complex simulators, and small practice vessels. Recently, a team of modeling and simulation students created a simple 2-D simulation that allows nascent ship-handlers to experience, and practice dealing with, the vector forces affecting a ship. This simulation could reduce weeks of classroom time into a few intense days of experimentation and learning. Activities like simulations, modeling, gaming, and role-playing place the learner in a dynamic environment in order to deal with complex or abstract issues.

Cloud computing consists of web-based systems that are usually subscriber driven. Systems like *Google* and *Yahoo!* are prime examples of cloud technologies. An example of a learning experience facilitated through cloud computing would be history lesson using the *Google Earth* Ancient Rome Layer (Google Earth 2011). Learners can log in and "walk" the streets of ancient Rome through thousands of historically accurate 3D buildings. Users may enter many of the buildings, and markers describe significant events. The uses for learning about Roman history are obvious. Consider approaches such as historical hunts where learners are given clues and must search the city for answers, or having students evaluate the location of the coliseum in relation to housing and how that would serve government interests. The options are virtually endless. Other technologies available in cloud computing are modeling and visualization applications, as well as an unlimited number of applications, activities, simulations, and games.

Jonassen et al. (2008) advocate active learning through the modeling of phenomena. They argue that using technologies to teach does not optimally use the strength of technology. Through computer modeling, learners create representations of the relationships they discover between elements in the world where they live. Building computer models is a powerful strategy for helping learners construct enduring mental models. Jonassen (2006) proposes using a variety of computer-based *Mindtools*, including databases, concept maps, spreadsheets, microworlds, systems modeling tools, expert systems, hypermedia construction tools, and visualization tools. He argues that students cannot use *Mindtools* without deeply engaging in thought about the content they are learning.

In addition to technology-based strategies that facilitate learners actively constructing knowledge, instructional strategies will target higher-order thinking in students. One straightforward way to understand what we mean by higher-order thinking is to present the types of activities that represent higher-order cognitive processing according to *Bloom's Taxonomy*. Table 3 presents the revised *Bloom's Cognitive Processing Taxonomy* (Krathwohl 2002). The further down the list, the higher the level of cognitive processing. Therefore, the highest levels of cognitive processing represented here are "analyze," "evaluate," and "create."

For distance education, this means that we need to be in the business of creating learner experiences that require learners to analyze problems, evaluate, and then create solutions. This is best achieved through active or constructive learning that presents challenges to learners, or groups of learners, and takes them through the process of solving complex and ill-structured problems. Constructive learning involves having learners wrestle with a problem, articulate their puzzlement, work with other learners to develop a solution, and then come to a common understanding of the meaning of the experience (Jonassen et al. 2008).

Learning activities that may be effectively used in distance settings include discussion, controversy, debate, panel discussion, role-playing, simulation, games, and group product creation (Johnson and Johnson 1985; Morrison et al. 2011). Having learners work in groups, or as individuals, to research a specific ill-defined problem, recognize patterns within the problem, and generate novel solutions is both motivating to students and an effective learning strategy.

Next generation distance learning will not only focus on learning strategies (and teaching strategies) but also will focus on the affordances of the technologically enabled space. Instructional strategies targeting higher-level cognitive functioning will be utilized extensively.

7. **The next generation of distance education will be characterized by evaluation practices that value higher-level cognitive processing and real-world problem solving.**

By definition, evaluation is measuring the value or worth of something against a standard. In distance education courses, this involves evaluating student performance against course objectives. However, if we are saying that higher-level cognitive processing and problem solving will be explicit goals, then they also need to be articulated as part of the course objective set, and evaluation systems should directly address this metric as well. *Bloom's Taxonomy* of higher-level cognitive processing is a good starting place to this end (see Table 2). As learning objectives are articulated, the taxonomy components associated with higher cognitive processing should be targeted. Therefore, in addition to specific performance objectives, students must also demonstrate skills in recognizing, recalling, evaluating, critiquing, creating, generating, planning, and producing.

Table 2 Bloom's cognitive processing taxonomy (p. 215)

Bloom taxonomy element	Components
Remember: retrieving relevant knowledge from long-term memory	Recognizing Recalling
Understand: determining the meaning of instructional messages, including oral, written, and graphic communication	Interpreting Exemplifying Classifying Summarizing Inferring Comparing Explaining
Apply: carrying out or using a procedure in a given situation	Executing Implementing
Analyze: breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose	Recognizing Recalling
Evaluate: making judgments based on criteria and standards	Checking Critiquing
Create: putting elements together to form a novel, coherent whole or making an original product	Generating Planning Producing

Any discussion of evaluation brings us close to the persistent constructivist vs. cognitivist debate regarding evaluation. Rather than engage in that debate, for our purposes here, let us take a postpositivist position (neither radically constructivist nor radically objectivist), and say that evaluation is rightly understood as learner performance against performance objectives, but that those objectives may include student-specific objectives. Since we are saying that many of our explicit learning goals involve higher-order thinking, then both the learning objectives and evaluation should reflect this.

The practice of learner self-evaluation against personal learning goals will increase. Much of the value of learning, regardless of theoretical orientation, is in how it matches learner goals and aspirations. There are many models for this, and the process for it will improve over the next few years.

So, evaluation in the next generation of distance learning, while still focusing on the assessment of objective learning, will also focus on higher-level cognitive processing skills apart from objective outcomes. And, it will increasingly focus on learner outcomes as measured against learner goals.

8. **Institutions will revise their rules and roles to match the requirements of distance learners, faculty, and other stakeholders.**
Distance education has moved from the backwaters of higher education to a place of prominence. We have seen an unprecedented level of growth in the number of students and courses offered over the last 10 years. This increase in numbers has been followed by an increase in distance education's prominence and importance to the educational establishment. To be successful in this emerging movement, institutions will be forced to reassess their roles and policies to match the needs of distance learners, faculty, and other stakeholders. Institutions that do the most effective job of preparing for the next generation of distance

education will be more relevant, stable, and better positioned to enjoy sustainable growth. Those that do not will be forced from the playing field.

Will this happen quickly? The answer is probably "no" since institutional patterns generally change slowly, but we are seeing evidence of a landscape in upheaval. As competition for students increases and institutions adjust to meet the requirements of an ever-more-demanding student population, the needs of distance learners, faculty, and other stakeholders will become more important.

What are the types of concerns that will need to be addressed and the kinds of policies and roles that will need to be adapted for the next generation of distance education stakeholders? Table 3 presents a brief overview of some of the relevant areas and concerns that will require strategic planning.

9. **The next generation of distance education will be characterized by a growing emphasis on the motivational design of instruction.**
By definition, learning is something learners must do: it is an action; it is a verb. And, as with any sustained action, learners must initially engage, maintain their engagement, make appropriate learning choices, and employ relevant metacognitive strategies to be successful. In other words, the motivation of learners is central to the act of learning. As we begin to see the distance education space as one in which learners are exposed to educational experiences that have volume, depth, and breadth, our ability to design motivational strategies for this environment will mature.

We are not the first people in the world to design motivational experiences, and we can learn much from other disciplines. Consider, for example, novelists and their penchant for the five part story (exposition, rising action, climax, falling action, and resolution). This is a pattern that authors have used for a long time to engage readers. In cinema studies, neurocinematics (Hasson et al. 2008) is the study of neural activity patterns of movie watchers in response to the film's plot. Cinematic researchers have made an effective study of engagement and can demonstrate how certain types of plots engage movie watchers. Another field that has mastered engagement is game developers. *World of Warcraft's* subscription base recently exceeded 12.5 million worldwide users (Blizzard 2010), and the game is commonly referred to as *World of War* "*crack*" because of its addictive quality with gamers.

Those game developers have discovered principles for gaining and keeping players' attentions. Czikszentmihalyi's (1990) work on flow and how people become caught up in the joy of an activity will also inform the motivational design of the next generation of distance education. Flow is the phenomenon of an individual being so caught up in an activity that he or she loses track of time and other environmental cues. The specific attributes of an experience that cultivate flow have been explicated by Czikszentmihalyi. And, of course, Keller's *ARCS Learner Motivation Model* (Keller 2009) continues to be one of the most useful models for the motivational design of instruction. What does this mean to distance educators? It means that game developers and researchers in other fields have cracked some of the mysteries of using technology to motivate and engage people. We would do well to learn from them.

Table 3 The next generation of distance education stakeholders and areas of strategic planning

Stakeholder	Areas of strategic planning for distance delivery
Students	• Course offerings • Equitable tuition and fees • Special needs/accessibility • Registration • Counseling and advising • Financial aid • Technology requirements • Community building • Library and other resource access • Other student services
Faculty	• Curriculum development • Scalability • Learning outcomes and assessments • Academic honesty/integrity • Course production and updating • Ability to customize courses • Collaboration • General lack of expertise and technical know-how • Maintaining learner-centered approach • Positive work environment • Accessibility • Community building • Fostering participation and support • Training and professional development • Workload/compensation/appreciation • Planning and revision time
Administration	• Institutional goals, vision, mission • Institutional beliefs, norms, values, and culture • Clear institutional policy and practice • Embracing of diversity • Admission criteria and process • Program offerings • Program evaluation/quality control • Staffing • Costs/return on investment • Scalability • Program accreditation • Credit transfers • Ability to adapt to changing technology • Legal concerns • Recruiting faculty
Other concerns	• Hardware • Software • Infrastructure • Staffing • Training

Adapted from Braimoh and Lekoko (2005)

10. **The "learning experience design" paradigm will have a profound impact on the routine design of distance learning experiences.**
The practice of systematic instructional design will not fundamentally change, but the paradigms of its practitioners—particularly as related to experiential learning options—will. Instead of designing instruction to specific objectives with a minimalist view of learner experience, designers will design to that same learning objective with a full view of the technological options available for rich experience. Learning experience design will become a significant paradigm.

    This is not new thinking. In calling for an "experience design" perspective, Shedroff (2001) harkens back to the learning perspectives of Dewey and Gagné. Dewey (1938) said it this way: "… the central problem of an education based upon experience is to select the kind of present experiences that live fruitfully and creatively in subsequent experiences" (p. 28). We conclude, then, that all experiences are learning experiences, but the ones that resonate in subsequent experience are the ones that will result in effective learning. Distance education experiences must compete for mindshare with other life experiences.

    This is not an argument for bells, whistles, or superfluous activity. This is an argument for the perspective that the future is about learning experience design, and that for distance education, the technologies available for enhancing the learning experience must be optimally employed. It would be irresponsible to ignore them. As we mentioned earlier, Morrison and Lowther's (2010) *NTeQ Model* is an example of how this may be applied in practice. In the *NTeQ Model* for integrating computers into K-12 classroom lessons, the specification of learning objectives is the first step, and then a review of relevant computer functions that may support learning is conducted. The *NTeQ* process model includes logical steps for designing learning that best integrates computer technologies with learning activities. The model will have to be adapted for use in higher education, but its foundational principles transfer.

    To summarize this perspective, the next generation of distance education will be characterized by an emphasis on designing learning experiences that have a resonant quality with learners. Current technology offers an incredible variety of functions toward this end. In practice, distance learning experiences may be designed using models like the *NTeQ Model* and *Keller's ARCS Model*. Frankly, what we present is only a modest start in this direction, the rest of the challenges outlined here will be met by researchers and practitioners active in distance education.

> The important thing is not to stop questioning (Albert Einstein).

These are exciting times. We stand at the threshold of an unprecedented opportunity to create approaches to distance learning that have not been possible before. Are people different? Do they learn differently? We believe the answer is "no." People are not all that different, and they learn in much the same way they always have. It is still critical that we use evidence-based instructional strategies as we design learning experiences. The key difference today is that we have amazing technology-enabled options to create resonant distance learning experiences. We are no longer constrained by the speed of the mail or the thin bandwidth of the early internet. The options for connection and experience are virtually unlimited. Taking our direction from leaders like Dewey and Gagné, we say that learning is the result of experience. Our task is to look around us, take account of the opportunities, and build distance learning experiences well. We owe it to ourselves and our future to harness the synergy of emerging technology and instructional design to usher in the next generation of unconstrained learning.

References

Blizzard. (2010). World of warcraft subscriber base reaches 12 million worldwide. Retrieved November 25, 2010, from http://us.blizzard.com/en-us/company/press/pressreleases.html?101007.

Bomsdorf, B. (2005). *Adaptation of learning spaces: Supporting ubiquitous learning in higher education.* In Paper presented at the mobile computing and ambient intelligence: The challenge of multimedia, Dahgstuhl, Germany.

Bonk, C. J., & King, K. S. (1998). *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse*. New York: Erlbaum.

Braimoh, D., & Lekoko, R. N. (2005). The need for policy framework in maintaining quality in open and distance education programmes in Southern Africa. *Turkish Online Journal of Distance Education—TOJDE, 6*(4), 95–105.

Carlson, N. (2011). Chart of the day: How many users does Twitter really have? *Business Insider*. Retrieved 31 Mar, 2011 from BusinessInsider.Com website: http://www.businessinsider.com/chart-of-the-day-how-many-users-does-twitter-really-have-2011-3

Czikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row.

DeMarco, T., & Lister, T. (1987). *Peopleware: Productive projects and teams* (2nd ed.). New York: Dorset House.

Dewey, J. (1938). *Experience and education*. New York: Touchstone. (First Touchstone Edition 1997 ed.)..

Google Earth. (2011). *Google Earth Ancient Rome layer*. Retrieved April 21, 2011, from http://earth.google.com/rome/.

Hasson, U., Landesman, O., Knappmeyer, B., Vallines, I., Rubin, N., & Heeger, D. J. (2008). Neurocinematics: The neuroscience of film. *Projections, 2*(1), 1–26.

Huett, J., Sharp, J., & Huett, K. (2010). What's all the FOSS? How freedom and openness are changing the face of our educational landscape. *International Journal of Open Source Software and Processes, 1*(2), 1–14.

Johnson, D. W., & Johnson, R. (1985). Classroom conflict: Controversy versus debate in learning groups. *American Educational Research Journal, 22*(2), 237–256.

Jonassen, D. H. (2006). *Modeling with technology: Mindtools for conceptual change* (3rd ed.). Upper Saddle River: Pearson Education.

Jonassen, D. H., Howland, J., Marra, R. M., & Crismond, D. (2008). *Meaningful learning with technology* (3rd ed.). Upper Saddle River: Pearson Education.

Keller, J. M. (2009). *Motivational design for learning and performance: The ARCS model approach*. New York: Springer.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy. *Theory into Practice, 41*(4), 212–218.

Marshall, S. (1997). Creating sustainable learning communities for the twenty-first century. In F. Hesselbein, M. Goldsmith, & R. Beckhard (Eds.), *The organization of the future* (pp. 177–188). San Francisco: Jossey-Bass.

Morrison, G. R., & Lowther, D. L. (2010). *Integrating computer technology into the classroom* (4th ed.). Upper Saddle River: Pearson.

Morrison, G. R., Ross, S. M., Kalman, H. K., & Kemp, J. E. (2011). *Designing effective instruction* (6th ed.). Hoboken: Wiley.

Preskill, H., & Torres, R. T. (2000). The learning dimension of evaluation use. *New Directions for Evaluation 88*(Winter 2000), 25–37.

Project Tomorrow. (2010). *Speak up survey data—2009.* Retrieved April 21, 2011, from http://www.tomorrow.org/speakup/speakup_your_data.html.

Reich, R. (1992). *The work of nations*. New York: Vintage Books.

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences, 4*, 155–169.

Rummler, G. A. (2007). *Serious performance consulting according to Rummler*. San Francisco: Pfeiffer.

Shedroff, N. (2001). *Experience design: A manifesto for the creation of experiences*. Indianapolis: New Riders.

Shepard, M. (2011). Creating a culture of digital collaborative in online learning. In L. Moller & J. Huett (Eds.), *The next generation of distance education: Unconstrained learning*. New York: Springer Press.

US Department of Education. (2005). *Toward a new golden age in American education: How the Internet, the law, and today's students are revolutionizing expectations*. Washington: USDE.

The Future of Distance Learning Technology: It's Not About the Technology and It's Not About the Distance

J. Michael Spector

Introduction

Many forms of learning involve some use of technology. Technology is inherently involved in distance learning. Some educational researchers and instructional designers claim that digital technologies are transforming the landscape of learning (e.g., see Visser and Visser-Valfrey 2008). Claims that technology has transformed learning are difficult to defend partly because it is a causal claim and partly because such claims are typically quite vague and general in scope. Nevertheless, one can easily find such claims in the refereed research literature as well as in popular magazines and trade journals. The fascination with new technologies and new technology-based approaches can lead to suboptimal learning designs and implementations (Kirschner et al. 2006; Perkins 1991; Spector and Merrill 2008). I have argued elsewhere that educators have a fundamental responsibility to first do no harm (Spector 2005). Improper use of technology and some instructional designs can further disadvantage students who lack proper preparation and training. In rare cases, a learning environment or instructional system can fail to teach critical skills resulting in undesirable consequences in real-world settings (e.g., see Dörner and Wearing 1995; Dörner 1996).

J.M. Spector, Ph.D (✉)
Educational Psychology and Instructional Psychology, The University of Georgia,
Athens, GA 30602, USA
e-mail: mspector@uga.edu

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If one adopts a skeptical attitude (i.e., an inquiring attitude driven by a sense of not knowing but wanting to learn more) with regard to particular technologies and learning approaches, one might be better positioned to fairly examine evidence of what works best in various circumstances. Merrill (2002) has attempted to do this, and he argues that instruction is likely to be effective when:

- Centered around meaningful problems and tasks.
- Learning goals and tasks are explicitly linked to knowledge and skills already mastered.
- New knowledge and skills are demonstrated in their natural context.
- Students have opportunities to work on a variety of related problems and tasks of increasing complexity with feedback from a variety of sources.
- Students can regulate their own performance and integrate new knowledge and skills into other activities.

In conjunction with the attitude of a skeptical inquirer, it is important to consider what evidence to collect and how it might be analyzed. All too often, assessments in educational research are based on superficial indicators of outcomes and fail to probe deeply. Learning is typically defined as involving stable and persisting changes in abilities, attitudes, beliefs, knowledge, or skills. Moreover, what we often want students to learn are skills, knowledge, and attitudes that will be important to their development and productive lives in society—at least one can find such claims in many academic and technical training programs. However, it rarely happens that evidence is presented of stable and persisting changes partly because such evidence is costly to collect and difficult to analyze. However, without meaningful assessments that are linked to intended goals and objectives that look at both proximal and distal outcomes, we are left to our intuitions and prejudices—instructional science degenerates into instructional alchemy.

Spector et al. (2003) argue that meaningful assessments are likely to develop when they are:

- Linked to meaningful and representative problems and tasks
- Aimed at helping students further develop knowledge and skills
- Used to assess real problem-solving abilities relative to prior performance and against established standards of competent performance
- Provided by multiple credible sources, including the learner, in a constructive context
- Designed to develop the ability to self-regulatory and metacognitive skills

It is probably fair to say that Merrill's (2002) instructional principles and the principles for meaningful assessment indicated above are not widely implemented. There are of course other instructional and assessment principles that could be cited that might be more widely known, accepted, and implemented. Nevertheless, I shall proceed on the basis of these principles and develop an argument about their relevance to distance learning.

Distance Learning

I adopt a standard definition of distance learning as learning that occurs in a context in which students are typically separated from their instructors on computer-based instructional agents, and typically from each other, for more than 75% of a course or instructional program. This is similar to the definition used by the Sloan Consortium (see Allen and Seaman 2010) as it includes a percentage of time so that distance learning can be distinguished from hybrid learning environments. The simplest definition of distance learning is learning in which students and teachers are separated by time and place. That early definition included the use of texts delivered to remotely located students as well as the use of video- and audioconferencing and the Internet. For my purposes, the actual definition that is adopted will not ultimately matter, because my argument is that regardless of the separation in time or place, or differences in language and culture, or percentage of the course involving such separations, what matters most is whether and to what extent learning occurs.

However, there is value in having a definition as it allows one to examine what is happening in comparison with other types of learning. For example, enrollment in distance learning courses continues to grow far in excess of increases in enrollments in traditional courses (Allen and Seaman 2010). In spite of that growth and in spite of evidence that distance learning tends to have a positive impact on the economy, faculty and administrators tend to have an increasingly negative attitude with regard to distance learning (Allen and Seaman 2010). The decline in attitudes on the part of university faculty, most of whom are not involved in distance learning, can be explained in part as a perceived threat to the prominence of traditional university faculty. A meta-analysis conducted by Means et al. (2009) found that students in distance learning courses in higher education performed better than their counterparts in face-to-face courses. A meta-analysis conducted by Storrings (2005) showed that attrition in university distance learning courses was comparable with that in face-to-face courses rather than much higher as many people believe. The findings from the meta-analyses, mostly confined to online courses in the USA, go against common beliefs that students do not learn well in distance settings and that there are high rates of attrition in distance learning courses.

It would appear that distance learning is being held to different standards than face-to-face instruction. This may in part be justified by an institution wanting to ensure that its image and reputation are not negatively impacted by distance learning courses that it offers, as these tend to be more visible than the instruction that occurs within the walls of the university. I find such a justification quite weak, however. Poor classroom instruction, particularly in large lecture settings, can also harm the image and reputation of an institution. Large lecture hall classes need not be deadly boring or ineffective, but they often are (Centra and Gaubatz 2005; Marsh et al. 1979). Distance learning courses, by contrast, are typically small with enrollments often capped at between 20 and 30. Limiting class size is a positive step towards effective instruction, although the size of the class has been shown not to have a large impact on learning outcomes (Ellis 1984; Smith and Glass 2005) except for very small groups and one-on-one tutoring.

What makes instruction effective? What makes good distance learning good? I have addressed these questions elsewhere (Spector 2007, 2008) and offer here a condensed version of my reasoning. Instructional design research tends to follow this line of thinking: (a) one can usually identify and document deficiencies in student or worker performance, and (b) an identified deficiency is a target for improvement, often through instruction. Two kinds of instructional improvement are usually proposed: (a) develop and implement improved instructional methods—these often new technologies and new approaches (possibly new blends of traditional approaches); only a few empirical studies demonstrate that a different method is in fact more effective (Richey et al. 2004), or (b) develop and implement improvements in instructor preparation and training; these may also include new technologies and approaches, and there are even fewer empirical findings demonstrating that improved instructor preparation and professional development have a sustained and positive impact on learning, which is not what we would all like to believe.

There are many evaluations of courses, both distance courses and face-to-face courses, since many institutions require student and teacher evaluations at the end of a course. Are these data reliable, and do they help answer the question, what makes a good distance learning course good? It seems reasonable to believe that the experiences reported by teachers and students would offer some indication of the quality and effectiveness of a course. However, the evidence suggests that good results seem to be correlated with a perception that students have positive attitudes with some being especially knowledgeable and well prepared prior to the course (Boone and Kahle 1998; Chen and Hoshower 2003; Filak and Sheldon 2003). It is then critical to gather attitudinal and motivational data at the beginning of a course, but this is rarely done. Some researchers record career preferences and changes in these preferences as indicators of a successful course, which is one, among other possible indicators (Yager and Yager 1985).

What is it that makes a good distance learning course good? Many will say that a good course sustains interest and promotes understanding. A reliable predictor of performance is time spent mastering a task (Ericsson 2004; Slavin 1998). Admitting that one does not know but wants to know (humility) and believing that one can learn with an appropriate level of effort (optimism) appear critical for effective learning—these attitudes might be considered preconditions for success on the part of individual students. Of course, to defend the claim that learning did occur, there must be independent measures of gains in knowledge and performance. A good distance learning course is one that promotes understanding, as indicated by measures of knowledge and performance, while sustaining interest, as indicated by preferences and subsequent actions on the part of students. This is true also for face-to-face courses.

Are distance learning courses different from face-to-face courses? Many obvious differences exist, particularly with regard to the required knowledge, skills, and expectations of teachers and students. Standards for judging the success of online courses ought to be comparable with those used to judge face-to-face courses. However, more emphasis on preparing and supporting distance learning teachers is a recognized requirement. Online environments require teachers to develop specific competencies (Klein et al. 2004). The good news in this regard is that many universities recognize that specific competencies are required for effective online instruction and are developing courses, workshops, and seminars to help teachers develop those competencies. Unfortunately, there is still too little emphasis on properly preparing students for success in distance learning courses, although the International Board of Standards for Training, Performance, and Instruction (ibstpi; http://www.ibstpi.org) has adopted this as a priority issue.

I have tried to establish two things thus far. First, distance learning courses are different in many ways from face-to-face courses. Differences exist with regard to the design of effective instruction as well as with regard to the preparation of teachers and students. Second, the factors relevant to determining the effectiveness of distance learning are basically the same as those pertinent for face-to-face courses. Admittedly, there are additional challenges in collecting and analyzing data in distance settings, but the underlying measures of learning effectiveness remain basically the same regardless of technologies and modalities used. I have presented this claim in other contexts, and it is generally accepted without much discussion; of course, that does not make the claim true. However, I have also tried to suggest that what typically happens in assessing learning and evaluating courses in distance settings reflects something altogether different—distance courses are evaluated by simplistic cost-effectiveness models (Spector et al. 2003), and individual assessment in distance learning courses is even more superficial than it is in face-to-face courses (Johnson et al. 2009).

Engineering Education

An example in aeronautical engineering education at the United States Air Force Academy (USAFA) will serve to illustrate many of the points made thus far. This case summary is based on my personal knowledge of the situation, which unfortunately was never formally documented. The case involves learning and instruction in the introductory aeronautical engineering course at USAFA in the period of time roughly between 1965 and 1985, prior to the advent of distance learning but well within the period in which computer technologies made their way into classrooms.

An overwhelming majority of USAFA freshmen would select aeronautical engineering as their initial choice for a major; this was true in 1965, as well as in 1985, and it was obviously encouraged by USAFA administration. However, after taking the first course in aeronautical engineering, a significant number of cadets would change their major to something else, such as International Relations or Civil Engineering, leaving less much less than half the cohort still majoring in aeronautical engineering. In the 1980s, the course was redesigned to be highly experiential with the support of sophisticated interactive simulations. The data on a standard final exam for this course were in USAFA archives covering a period of nearly 30 years. These data were examined to see whether knowledge and performance improved with the introduction of the redesigned course. Whether or not the final exam was a fair indicator of knowledge and performance was not examined.

The course redesign was extensive and quite dramatic, introducing small group projects oriented around the new simulation-based learning environment; there was no textbook; and groups were encouraged to design the most effective solutions to a number of increasingly challenging aeronautical engineering problems. However, there was virtually no improvement in final exam scores. Was the redesign a failure? Hardly. What did change significantly was the number of cadets who retained their aeronautical engineering major. The design was effective in terms of the objective to have cadets major in aeronautical engineering and pursue careers in the air force related to aeronautical engineering. One conclusion is that a distance learning course need not be more effective than its face-to-face counterpart in order to be considered a success. A second conclusion is that it is not only learning and performance that make a course good—looking at longer-term impact is also relevant. A third conclusion is that sustaining interest in an area is perhaps a worthwhile goal, and this can be easily measured; it is certainly true that technology can be used to gain and sustain interest as well as to promote instructional efficiency, and these are important considerations for the design of distance learning courses.

It is worth bringing this story from 1985 to 2010 with a brief look at what is happening in the area of engineering education in general. As with many other technologies, digital engineering technologies are becoming much more powerful as well as smaller and more affordable. Digital fabrication is a case in point. Cornell University researchers have developed tools for desktop fabrication and 3D printing (http://ccsl.mae.cornell.edu/papers/HOMA08_Vilbrandt.pdf). The Fab@Home project at Cornell is dedicated to building and using machines that can make almost anything at almost any location. The hardware designs and software are provided by Cornell at no cost and are open-source (http://www.fabathome.org/wiki/index.php?title=Main_Page). The FAb@Home kit costs about $1,600; for about $2,000, one (teacher, student, school, or researcher) can have a fully functional desktop fabricator linked to CAD software with supplies to support the creation of a number of physical objects.

The focus at Cornell has been on the technology—on creating powerful, flexible, and affordable digital fabricators. It is clear that engineering practice will make even more extensive use of digital fabrication in the future. It makes sense that engineering education should be using similar tools to prepare future engineers. The Cornell technology offers three significant affordances for education. First, it allows a student to see the consequences of a design in a 3D object quite quickly—rapid prototyping is made effective and affordable. Second, it allows a student in one location to share the design with a student at a different location who also has the fabricator. Language and culture are bypassed by the actual prototype the remote student prints using the 3D printer. Because the technologies are digital, the important modeling process required to create designs that can be fabricated easily lends itself to use in distance learning. Moreover, these digital designs can be easily shared via the Internet across the boundaries and barriers of language, culture, and prior preparation and training. Finally, because the devices used to print and fabricate are affordable, they can be placed in many different settings, and they reflect what professional engineers are doing on the job. These uses of technology make meaningful distance learning in the area of digital engineering quite affordable and practical.

The following remarks are taken from my blog (http://aect-president-2009-2010.blogspot.com/):

> The 3D printer also could be controlled by modeling or CAD/CAM software. This printer is available for the remarkably low price of $1,600. Here is how it works—you will of course have to use your imagination. First the layout/specifications for the three dimensional object are entered into a modeling or CAD/CAM program. This layout controls the printer which is a customized version of an inkjet printer that uses tubes instead of ink cartridges. The tubes can hold any stuff that will solidify after exposure to room temperature air—this includes liquid metals and plastics, latex, and even CheezWhiz. Gee whiz. Really? Really! The printing occurs a layer at a time with each layer being about 1 mm thick. On each pass, the printer squeezes the molding material out of the tubes according to the specifications in the modeling program. Gradually, layer by layer, the 3D object is created. We saw bicycle chains, chess pieces with embedded objects, a metal impeller, and other complex objects that had been printed using this technology. Imagine that. For about $2,000 you and your students can be in the business of creating all sorts of objects. Cornell is pursuing this line of research in part due to its tremendous educational potential. Since modern engineers use similar tools to prototype and test various objects, it makes sense to train engineers using the tools, technologies, and techniques they will encounter after graduation. How obvious is that? The challenge was to create affordable technologies for use in university engineering programs, and it appears that Cornell has succeeded. Imagine that college students in Ithaca, New York can create plans for objects that could be viewed, refined, and printed/created by college students in Beijing, China.

Concluding Remarks

Thanks in part to such remarkable technologies, we have come a long way in enriching education, and the possibilities and implications for distance learning are significant and the possibilities and implications for distance learning are significant (Carr-Chellman 2005). In spite of such amazing possibilities, we still need to regard learning as a process involving stable and persistent changes in abilities, attitudes, beliefs, knowledge, performance, and skills, then we need to take care to design, implement, and evaluate appropriate assessments.

References

Allen, J. A., & Seaman, J. (2010). *Learning on demand: Online education in the United States, 2009*. Report for the Sloan Consortium. Newburyport, MA: The Sloan Consortium. Retrieved June 18, 2010, from http://www.sloan-c.org/publications/survey/pdf/learningondemand.pdf.

Boone, W., & Butler Kahle, J. (1998). Student perceptions of instruction, peer interest, and adult support for middle school science: Differences by race and gender. *Journal of Women and Minorities in Science and Engineering, 4*, 333–340.

Carr-Chellman, A. A. (Ed.). (2005). *Global perspectives on e-learning*. Thousand Oaks: Sage Publications.

Centra, J. A., & Gaubatz, N. B. (2005). *Student perceptions of learning and instructional effectiveness in college courses*. A report for the Educational Testing Service. Princeton: Educational Testing Service. Retrieved June 18, 2010, from http://www.ets.org/Media/Products/perceptions.pdf.

Chen, Y., & Hoshower, L. B. (2003). Student evaluation of teaching effectiveness: An assessment of student perception and motivation. *Assessment and Evaluation in Higher Education, 28*(1), 71–88.

Dörner, D. (1996). *The logic of failure: Why things go wrong and what we can do to make them right* (R. Kimber & R. Kimber, Trans.). New York: Metropolitan Books.

Dörner, D., & Wearing, A. (1995). Complex problem solving: Toward a (computer-simulated) theory. In P. A. Frensch & J. Funke (Eds.), *Complex problem solving: The European perspective* (pp. 65–99). Hillsdale: Lawrence Erlbaum.

Ellis, T. (1984). *Class size*. ERIC digest number eleven. Eugene, OR: ERIC Clearinghouse on educational management. Retrieved June 18, 2010, from http://www.ericdigests.org/pre-922/size.htm.

Ericsson, K. A. (2004). Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. *Academic Medicine, 10*, S1–S12.

Filak, V. F., & Sheldon, K. N. (2003). Student psychological need satisfaction and college teacher course evaluations. *Educational Psychology, 23*(3), 235–247.

Johnson, T. E., Ifenthaler, D., Pirnay-Dummer, P., & Spector, J. M. (2009). Using concept maps to assess individuals and team in collaborative learning environments. In P. L. Torres & R. C. V. Marriott (Eds.), *Handbook of research on collaborative learning using concept mapping* (pp. 358–381). Hershey, PA: "http://www.igi-global.com/reference/details.asp?ID=34574" \o "Information Science Publishing" \t "_blank" Information Science Publishing.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential and inquiry learning. *Educational Psychologist, 41*(2), 75–86.

Klein, J. D., Spector, J. M., Grabowski, B., & de la Teja, I. (2004). *Instructor competencies: Standards for face-to-face, online and blended settings*. Greenwich: Information Age.

Marsh, H. W., Overall, J. U., & Kesler, S. P. (1979). Class size, students' evaluation, and instructional effectiveness. *American Educational Research Journal, 16*(2), 57–70.

Means, B., Toyama, Y., Murphy, R., Bakia, M., Jones, K. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Report for the U.S. Department of Education, ED-04-CO-0040. Washington: US Department of Education, Office of Planning, Evaluation and Policy Development. Retrieved June 18, 2010, from http://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf.

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development, 50*(3), 43–59.

Perkins, D. N. (1991). Technology meets constructivism: Do they make a marriage? *Educational Technology, 13*, 18–23.

Richey, R. C., Klein, J. D., & Nelson, W. A. (2004). Developmental research: Studies of instructional design and development. In D. H. Jonassen (Ed.), *Handbook of research on educational communications and technology* (2nd ed., pp. 1099–1130). Mahwah: Lawrence Erlbaum.

Slavin, R. E. (1998). Effects of student teams and peer tutoring on academic achievement and time on task. *Journal of Experimental Education, 48*, 253–257.

Smith, M. L., & Glass, G. V. (2005). Meta-analysis of research on class size and its relationship to attitudes and instruction. *American Education Research Journal, 17*(4), 419–433.

Spector, J. M. (2005). Innovations in instructional technology: An introduction to this volume. In J. M. Spector, C. Ohrazda, A. Van Schaack, & D. A. Wiley (Eds.), *Innovations in instructional technology: Essays in honor of M. David Merrill* (pp. xxxi–xxxvi). Mahwah: Erlbaum.

Spector, J. M. (Ed.). (2007). *Finding your online voice: Stories told by experienced online educators*. Mahwah: Erlbaum.

Spector, J. M. (2008). What makes good online instruction good. In J. Visser & M. Visser-Valfrey (Eds.), *Learners in a changing learning landscape: Reflections from a dialogue on new roles and expectations* (pp. 251–266). Dordrecht: Springer.

Spector, J. M., Doughty, P. L., & Yonai, B. A. (2003). *Cost and learning effects of alternative e-collaboration methods in online settings* (final report for the Andrew W. Mellon Foundation cost effective use of technology in teaching initiative). Syracuse: Syracuse University.

Spector, J. M., & Merrill, M. D. (2008). Special issue: Effective, efficient and engaging (E^3) learning in the digital age. *Distance Education, 29*(2), 153–164.

Spector, J. M., Milrad, M., & Davidsen, P. I. (2003). Model facilitated learning. In S. Naidu (Ed.), *E-learning: Technology and the development of teaching and learning*. London: Kogan Page.

Storrings, D. A. (2005). A*ttrition in distance education: A meta-analysis*. Unpublished dissertation, Syracuse University, Syracuse, NY.

Visser, V., & Visser-Valfrey, M. (Eds.). (2008). *Learners in a changing learning landscape: Reflections from a dialogue on new roles and expectations*. Dordrecht: Springer.

Yager, R., & Yager, S. (1985). Changes in perceptions of science for third, seventh, and eleventh grade students. *Journal of Research in Science Teaching, 22*(4), 347–358.

Rethinking Design and Learning Processes in Distance Education*

Andrew S. Gibbons and Michael E. Griffiths

Introduction

In this chapter, we discuss an innovative view of designed instructional artifacts that we feel provides a key to the next-generation concept of distance education—and perhaps for the next-generation concept of designed instructional artifacts of any type. We begin with the assumption that what designers *think* they are designing guides their choice of the design architecture and of the building blocks they use in their designs. As designers come to think in terms of the new categories of designed artifact, new design abstractions and structures suggest themselves, and innovation in design is a natural result. The broader vision of what is designed at a deep level leads to revising traditional surface categories, which in turn leads designers to ask and answer new design questions.

We will appeal to Krippendorff's *trajectory of artificiality* (Krippendorff 2006), a continuum of abstract artifact configurations, suited to socially defined design goals. Krippendorff, who is a design theorist and not an instructional designer, defines a progression of user-centered design targets—"things" that can be designed. At one end of Krippendorff's continuum are artifacts which do not require social interaction and personal commitment. At the other end are artifacts that cannot perform their function without a great deal of social interaction and personal commitment. Krippendorff's trajectory reasserts the interpersonal factor in designs. If designers want to increase the interpersonal values of instruction—in a technological age that seems to be subtracting those values—attention should be focused toward the upper end of Krippendorff's continuum.

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A.S. Gibbons, Ph.D (✉) • M.E. Griffiths, Ph.D
Department of Instructional Psychology and Technology, David O. McKay School of Education, Brigham Young University, 150-C McKay Building, Provo, UT 84602, USA
e-mail: andy_gibbons@byu.edu

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Krippendorff's categories of designed artifacts represent a social dimension. Alternative ways to define the designer's perception of what is being designed have been described. Gibbons (2003) proposed that most novice instructional designers tend to think in *media-centric* terms, meaning that the constructs most central to their designs tend to be those provided by the medium—for example, the web page, whose structural building blocks include "page," "table," "frame," and "resource."

Gibbons describes how a new design target, such as the content and order of instructional messages, shifts the designer's priorities to different constructs. Gibbons describes this as *messaging-centric* design, which is usually characterized by the design goal of "telling or explaining" more effectively. The building block constructs that dominate a message-centric design emphasize a more effective and memorable ways of conveying ideas—better "explanations," "narrations," "examples," better use of visuals to tell a story, "animations," more complementary use of text and visuals together, better and sequencing of key ideas, and interactions that focus attention and processing on message content. The focus shifts from designing a media product to designing the presentation of ideas. The constructs involved become more abstract and removed from concrete media constructs.

According to Gibbons, designers later tend to migrate to yet another structural principle which leads them to adopt strategic formalisms as the priority organizational structures in their designs. Gibbons refers to designers in this stage of thinking as *strategy-centric* because some set of formalisms such as "presentation," "practice," "demonstration," "drill," "modeling," or "articulation" become priority structures, while other structures take on secondary importance. The explanations that were central in the previous stage of design maturity do not disappear, but they are now subordinated to the purposes of a larger strategic plan, whether the plan is precise and detailed or broad and ill-defined.

As a designer matures through these different stages of construct-centrism in their thinking, the values of previous stages are not lost nor does every novice designer go through the same progression of stages. However, it is certain that as designers mature in their craft, new abstract structuring principles are given priority, while others remain important but become subordinate in the priority of design decisions. This pattern of migrating priorities is essentially structural and strategic. At each stage, a different set of design purposes control the unfolding of the design. In contrast, the organizing pattern of Krippendorff's trajectory, which is described in detail in the next section, is social interaction and commitment. This chapter proposes that just as a designer's vision of what is being designed can mature in strategic ways structurally, it can and probably should mature also in terms of the social and interpersonal commitment dimension. The end, we believe, will be something beyond traditional distance education forms, but that result will only be possible if designers begin to focus in their thinking on the kinds of design targets described by Krippendorff.

This chapter is in two parts: the first part outlines Krippendorff's continuum of design architectures and briefly discusses its implications, and the second part describes a design project that illustrates how designing in the spirit of Krippendorff's categories led to an innovative and successful instructional solution that emphasizes social values over technical values.

Krippendorff's Trajectory of Artificiality

Krippendorff describes what he calls a "trajectory of artificiality" by which he means "a trajectory of … design problems," "each building upon and rearticulating the preceding kinds and adding new design criteria," "extending design considerations to essentially new kinds of artifacts" (Krippendorff 2006, p. 6). Krippendorff's trajectory of design problems invites the designer to answer the question, "What kind of thing are you designing?" The trajectory describes a fault line between artifacts that are used by individuals in isolation with little sustained commitment and those that require social responsiveness and sustained personal commitment from the users. Krippendorff's trajectory defines design problems in terms of their social goals: each type of problem defines a particular kind of social relationship between the user of the artifact and others. In this respect, Krippendorff's continuum transcends traditional categories of designed artifact, especially for instructional designers, who commonly describe their artifacts either in terms of mediation (e.g., distance education, blended instruction, web-based learning), enactment (e.g., simulation, role-play, tutorial), or instructional strategy (e.g., problem-based learning, direct instruction, apprenticeship, simulation). Krippendorff classifies design problems in terms of the degree to which the artifacts created bring people or technologies together in joint activity and by the level of commitment and participation required of them.

Table 1 provides a list of descriptors for each type of artifact on the trajectory. Krippendorff has given new meanings to common terms (such as interface and project) and has used them as category labels, so special care must be taken to note and remember Krippendorff's exact definitions. Krippendorff does not directly address an instructional designer audience: his writing is about design in general. This is important because it provokes instructional designers to reevaluate their concept of "instructional artifact" alongside Krippendorff's broader conception of "artifact for social interaction." Most instructional designers will find that Krippendorff's categories create or enlarge one or more of their own existing categories of "instructional artifact."

Krippendorff's categories of design problem are cumulative. Each new problem upward on the trajectory presupposes and includes within its scope the previous type of problem. This is best seen by working backward from the most inclusive category at the far end of the trajectory. *Discourses*—the most inclusive of the problem types—are carried out through the device of individual *projects*. Projects operate using the mechanisms of *multiuser systems/networks*, which in turn require *interfaces*, which provide *goods*, *services*, *and identities*, that involve the use of *products*. A designer's job does not involve choosing one design problem to the exclusion of the others as much as it involves climbing upward using the continuum of problems to reach the level of problem that leads to the most powerful and innovative design solutions for a given context and purpose. To repeat an earlier point, designers who think they are designing "a product for distance education" will tend to use the structural constructs that already populate thinking about such designs. Designers who think they are designing "goods, services, and identities" will find

Table 1 Definitions of Krippendorff's artifact categories

Krippendorff artifact category	Krippendorff description	Instructional design examples
Products	• The end result of a manufacturing process • Designed according to producer's intentions • Intended to be used in a particular way	• "Packaged" instructional modules
Goods, services, and identities	• Manufactured to be traded and sold • Meant to acquire exchange value • Qualities not of a tangible kind • Concerned with marketability • Possess symbolic qualities that encourage being acquired • Designed to appeal to diverse perceptions and local values • Consumer goods • Possible qualities: stability, dependability, reputation, values	• "Reusable" instructional resources • Online instruction vendors providing multiple courses • Charter schools • "Brands" of instruction (Khan Academy) • Universities • Graduate schools (Wharton School of Business)
Interfaces	• Human interfaces with technologies (computers, airplanes, power plants, automotive controls) • Create interactivity—action–response sequences • Create dynamics—changeability over time, endpoint seldom same as departure point • Create autonomy—provide space for unpredictable action by user • Created to extend human action and amplify user's mind • No "correct" usage patterns • Possible qualities: understandability, user-friendliness, transparently, reconfigurability, adaptability, intelligence	• Personal learning environments • Learning management systems • Knowledge management systems • Database tools and interfaces • User interface standards • Virtual reality, user-configurable environments • e-mail • Productivity tools
Multiuser systems/ networks	• Coordinate human activities across space and time (traffic lights, wayfinding systems, signage systems, information systems, accounting systems, communication systems, telephones, computer networks) • Provide a place where people connect, form, and coordinate the activities of their own communities of interest or practice • Designers cannot control how the system is used • Provides facilities that allow users to organize themselves • Possible qualities: informaticity, accessibility, connectivity	• The Internet • Social software (Facebook, Twitter) • Collaborative workspaces • Google Docs

(continued)

Table 1 (continued)

Krippendorff artifact category	Krippendorff description	Instructional design examples
Projects	• Form around a desire to change something • Usually a knowledge goal or a cause involved • Require coordination of many people united in purpose (campaign, research, charitable action) • Purpose or goal may be mutable, may evolve • Require designer to address how to achieve cooperation among people • "Attracts" people • Involves language and a narrative (how, what, and when to change) • Must motivate commitment, coordinate contributions, direct activities • Designed by a group or by "the" group (not single designer) • Not controlled by the designer, controlled by stakeholder group • Designer suggests direction, provides space, shows possibilities, attracts resources	• Reusable learning resource repositories • Participatory and user-design spaces • Wikipedia • The Tipping Bucket
Discourses	• Organized ways of talking, writing, and acting • Resides in community • Directs attention of community members • Defines "what matters" • Entails tension between reusing established forms and innovating • Place where new metaphors, vocabularies, discourses arise • Involves new ways of conceptualizing the world • Designers derive their identity from community • Possible qualities: solidarity, generativity, rearticulable	• Behaviorism, cognitivism, constructivism, all future-isms • The current movement to reconceptualize instructional design • All of the discourse communities in instructional technology. Threads and special interest groups defined as optional interests at professional conferences (gaming, reform, design, etc.)

that they need a different set of conceptual tools with which to attack the problem. A similar effect is produced at each escalation up the continuum. Both of the continua we have described place the varied design configurations found in the distance education literature in perspective. These continua therefore represent bases for grounding a design rationale.

Krippendorff's categories of design problem suggest new applications of media in support of socially defined design goals. They lead to innovations inspired by placing priority on social values and commitment.

An Illustration of Value Obtained Through Escalation up the Continuum

The remainder of this chapter describes how extra value was produced for one research-oriented design project by escalation upward on the Krippendorff continuum. What was originally presented as a *product* design problem was reconceived as a *multiuser system/network* in Krippendorff terms—three positions upward on the continuum. The result was an innovative instructional design configuration that transcended traditional standards, providing students with greater amounts of individual attention and feedback than they would normally receive, even in a live classroom experience.

The design effort began with the need to create an online version of an existing technology-for-teachers service course. Because the project served also as a vehicle for a doctoral dissertation (Griffiths 2010), emphasis was placed on innovation, research, and theoretical grounding.

From the outset of this project, the designer's goals were to achieve increased personalization and individualization of instruction. He hoped to provide an example contrary to what he saw as a troubling tendency of technology-enhanced instruction to reduce both personalization and direct human contact. At the same time, the researcher realized that one of the primary values of distance education is time flexibility for the learner, so one of the design criteria was also asynchronicity.

The research study was pursued according to the guidelines for a *designed cases* methodology for formative research described by Reigeluth and Frick (1999) "that is intended to improve design theory for designing instructional practices or processes" (p. 633). As Reigeluth and Frick acknowledge, the formative research method is part of a growing tradition of research and philosophy called "design experiments" (Brown 1992), and or more recently "design-based research." There is a rapidly expanding literature on design-based research in a variety of sources (Barab and Squire 2004; Dede 2005; Kelly et al. 2008; Kelly 2003; Sandoval and Bell 2004; van den Akker et al. 2006).

The common goal of formative and design-based research is the evolution of theory by the means of the design, development, testing, revision, and recurrent retesting of instructional artifacts, processes, and environments. A key practice in this form of research is the cyclic revisitation and reassessment of the fundamental questions and theories that initially prompted the research. The expectation is that both questions and theory are malleable and are expected to change with each round of data collection and analysis. While the emphasis of formative research is "to create generalizable design knowledge" (Reigeluth and Frick 1999, p. 634), the emphasis of design-based research tends to be more toward the creation of situated (local) domain theories to enhance instructional method. Our view is that since both design theory and domain theories impact design-making, the evolution of both kinds of theory should be pursued (see Gibbons and Rogers 2009).

Formative research using Reigeluth and Frick's *designed case* method was appropriate for this present project because designed case research "[does] not start with an existing design theory" (Reigeluth and Frick 1999, p. 644). Over the course of the project, some theoretical foundations were established allowing the researcher to construct an asynchronous video learning model (AVLM) over the course of multiple implementation and revision cycles.

The initial commitment of the researcher was to search for "how the valuable elements of face-to-face experience can be reproduced or replaced in an online setting" (Griffiths 2010, p. 15). The critical design challenge, however, was that "live experience removes time flexibility, one of the largest benefits of online education" (p. 16). The goal became to design asynchronous online instructional experience that maintained, to the greatest extent possible, the sense of immediacy and social presence: an atmosphere in which "students know their instructor and feel that they are known" (p. 17). This simplistic statement of the design goal was refined over time with a more detailed one using the "(re-)defining the characteristics of artifacts" design technique described by Krippendorff (2006, pp. 232–240).

The "(re-)defining characteristics" method, applied in this project intuitively at first, and then later more deliberately, consists of defining a field of synonyms that taken together capture the essence of the artifact being designed. That list of characteristics grew over the course of the project to include: genuine, exhibiting good will, trusting, safe, accepting, aware, sensitive to moods, interesting, friendly, engaging, motivating, challenging, understanding, immediate, close, committed, showing humor, showing personality, responsive to emotional states, caring, interactive, participative, conversational, giving prompt feedback, empathetic, intentional, time-flexible, having expectations, adaptive, individualized, spontaneous, consistent, having prolonged engagement, rapidly paced, and responsive in a timely manner. Defining these characteristics created a more detailed view of the design target, which was clearly to place the highest priority on the interpersonal values of instruction.

The communications medium selected for the project was asynchronous exchange of recorded video clips because of video's ability to fulfill a greater number of the listed characteristics than other feasible media alternatives and because asynchronous exchange fit the learner's need for flexible scheduling. Video recordings provide nonverbal cues that can be read visually to convey a much broader spectrum of relevant information about a person's affective as well as cognitive and physical state, affording the instructor and the learner, if they desire it, the foundations of a more personal relationship. The delay in the exchange of video clips due to asynchronicity was seen as a comparatively minor concern in the face of the greater benefit obtainable from the more personal video contact. However, the frequency of contact was seen as a critical variable, and so it was decided that learner clips would be answered with a response within 24 hours. The apparent problem that attended this commitment was the possibility that the instructor's time might become overly used. Therefore, both learner and instructor clips were limited in length. This commitment also turned out to be necessary because of the factor of disk space, which filled rapidly when clips were allowed to be long.

In the early stages of this research and development project, theoretical foundations were sought to ground and give direction to the set of desired characteristics previously listed. Influences were found in the Seven Principles for Good Practice in Undergraduate Education (Chickering and Gamson 1987). A useful theoretical framework was also found in the Community of Inquiry Framework (Garrison et al. 1999), which focuses on three main concerns: social presence, cognitive presence, and teacher presence. The dimension social presence, which relates to the projection of personality and emotion, was of special interest to this project. This dimension allows people to represent themselves "as real people in a **community of inquiry**" (Arbaugh et al. 2007, p. 21, emphasis in the original). Social presence is further defined by Garrison et al. (1999) as the ability to express and receive emotions that are normally present in conditions of close proximity, the ability to communicate respectfully and reciprocally, and the feeling of being a part of a cohesive group.

The research was accomplished in three rounds of design, revision, and retrial consisting of three semesters of teaching the technology-for-teachers course for junior and senior preservice teacher education students at BYU. Following each semester's experience, the researcher analyzed the data, revisited the theory base of the research, reevaluated the questions of the research, and modified the designed artifacts (syllabus, instructor guidelines, learner guidelines, etc.) used during course implementation. Participants in the research were course registrants in a normally face-to-face course who volunteered to participate in the online version instead. With each new round, significant advances were made in the key areas of concern of the research: theory-basing, linking of theory to practice, and application of research methodology.

Research Round 1

Round 1 of the research concentrated on establishing basic communications infrastructures and software, setting equipment and software standards for students, establishing first-version guidelines for learner and instructor roles, arranging a system for video clip exchange, and creating the first version of the syllabus. These practical concerns were disciplined by theoretical concerns so far as the theory base development had proceeded. Guiding principles included (a) the centrality of the learner–instructor relationship and (b) published definitions of immediacy, which were used to identify strengths and weaknesses in the application of the video process.

In the first round of research, students recorded webcam clips on their computers using various software products and e-mailed the resulting video files to the teacher. The teacher sent video feedback to students in the same manner through e-mail. The result of using webcams to record video clips to send to students and the instructor was that the students were able to see the instructor giving instructions, announcements, feedback, and encouragement; the instructor was able to see each student responding to assignment questions; and both parties were able to observe the verbal and nonverbal cues that people naturally use to convey context and overall meaning in personal communication.

Data analysis was based on instructor experience and observations, student comments, and scores from the university's student course rating system. The research question was whether a strong instructor/student relationship could be established with no actual physical presence. The results of this round produced some unexpected findings, summarized in the statement of one student that "it was much more personal this way, even more so than a face-to-face class usually is." Student ratings for the asynchronous online group were higher than those for any of the face-to-face sections of the class in every rated dimension.

Other effects emerged which were unanticipated. One positive aspect was related to the student video introductions. Students presented themselves and their background to other students. Each was asked to describe something unique about themselves. The teacher felt that he was able to make a personal connection to each student, even more so than he had experienced in teaching face-to-face classes. Another positive result was related to the individualized feedback that the teacher sent to students. Initial feedback from students suggested that they felt that they received much more personal feedback than they are used to receiving. For example, one student stated that "even though this was an online course and I did not see the instructor as much as my other professors, he provided me more one-on-one time than any other professor." Another important result was the nature of student responses using the webcams. The teacher reported that when the students presented answers to questions in videos, they would share their knowledge in a more fulsome and open manner than they would if they were writing. The teacher was better able to see how well the students understood the topics and was therefore able to give more accurate feedback. Details of Round 1 of the research are provided by Griffiths and Graham (2009).

Lessons Learned: Round 1

Many lessons were learned from the experience in Round 1, mostly related to technological implementation. There had been many issues with technology that required time and effort on the part of the instructor to resolve. Some students purchased the most inexpensive webcams and had problems with them. Sending video files as e-mail attachments caused several problems. Some students did not understand what it meant to create a video clip file. They understood how to use the software and to record a clip, but they did not understand the fact that in doing so, they had created a file somewhere on their computer. If they could find the file to attach to an e-mail, the file would often be too big to send, and some students did not understand what it meant to create a smaller lower-quality file that would be small enough for an e-mail attachment. In addition, sending and receiving many video clip files meant that e-mail boxes would become full very quickly, which frequently caused the instructor and some students' problems. Posting general announcement video clips and instructional video clips on the class web site proved to be troublesome due to file size restrictions, and some students who downloaded the files could not view them for various computer setup reasons. It was clear that using generic e-mail as the vehicle for sending and reviewing video clips was not a good solution.

Research Round 2

Round 2 of the research involved improvements in the theoretical base, in practical guidelines and policies for daily interaction, and in the scope and quantity of data gathered and analyzed. It also made apparent the need for a practical coherent body of local domain theory capable of guiding the design of instruction mediated through asynchronous conversations. The intent of the theory would not be to formalize the design of such environments but to begin to clarify essential vs. desirable vs. unnecessary elements of such designs. In this way, the theory would have generative power without prescribing in detail. The additional theory applied in Round 2 came from the Community of Inquiry Framework (Arbaugh et al. 2007), specifically that part related to the social presence dimension.

In the second round, a larger number of assignments were submitted by students in the form of webcam-recorded presentations. In addition, some new methods were devised for achieving collaborative student learning using asynchronous video. To resolve the problem of sending video clips as e-mail attachments, programmers in the Center for Teaching and Learning at BYU developed a web site for video-mail exchange within the format of blog pages. On this video blog web site, the instructor was able to create blog pages for group work where student groups could post and view video clips (recorded via webcam on the site). Also, the instructor was able to create private blog pages accessible only by individual students. This allowed the instructor to privately communicate via video mail with individual students and also allowed students to collaborate by posting video mails on group blog pages. The instructor also created a blog page which was accessed by all students for general announcements. Participants received notification e-mails when fresh videos were posted on the blogs they had access to.

Two forms of group discussion using asynchronous video were devised. The first was based on groups of three of four students. Students in the group first posted a personal video containing their ideas on solving a particular classroom instruction problem. This was followed by watching the videos of the other students in the group. Then, they posted a second video expressing what they had learned from the other students and also what they believed to be their ultimate solution.

The second form of group discussion involved chain responding. The exercise included presenting and discussing ideas on how to solve a certain classroom instruction problem. Students were first required to watch the two most recent student posts. Then, in their own video post, students were required to discuss the ideas from each of the previous two video posts. They were also required to present their own unique idea.

Round 2 student comments from the online course rating system for the video group were as positive as the comments made by students during Round 1 of the research. Most students in the class responded to a survey based on the social presence component of the COI measurement instrument as described in Griffiths and Graham (2009). This survey included nine questions designed to reveal the level of existence of the constructs of affective expression, open communication, and group cohesion. The survey questions were based on 5-point Likert scale, and each of the three constructs included three questions. The results of the measurement instrument when averaged for each construct were as follows: affective expression = 3.44, open communication = 4.42, and group cohesion = 4.23. The affective expression construct received the lowest rating. As affective expression as defined in this study is critical to the success of using asynchronous video, improvement was needed in this construct.

Lessons Learned: Round 2

There were technical lessons from Round 2, which included the discovery of newly emerging online asynchronous video exchange services that relieved the troublesome use of individually e-mailed video clips. The importance became apparent not only of managing individual video clips but also of managing and keeping track of conversations requiring the exchange of multiple clips. The focus shifted from the individual clip unit to the conversational unit: the thread. At midsemester, an additional home-grown tool, a video blog interface, was completed and implemented, which made tracking threads and conversations even easier.

In terms of the value of different kinds of conversation, it was learned that making video clips of students available to other students had a beneficial effect and that it increased the cohesion of the class, adding an additional desirable dimension of face-to-face instruction. It was also found possible to involve students in limited collaborative interactions through the video clips.

At this point, it became apparent that what was being designed was not just a mediation of a university course but a networking space (in Krippendorff terms): in this case, a space in which individuals were made more immediate and present through the use of video. Whether it was the improvement in tools that had made the conversational structure more apparent or the experimentation with collaborative interactions that shifted the attention of the researcher back to the social dimension is not sure. The result, however, was a deepening understanding of the effect of the designer's conceptions of what was being designed on the design itself. Though the Krippendorff trajectory of design problem types described earlier had not come to the attention of the researcher at this point, retrospectively, this point in the research was when the researcher refocused on the design task not as media product but as a networking space in which traditional instructional forms could be reevaluated in terms of their social priorities. From this point forward, attention to the technical and product aspects began to answer more fully to the original intentions of the research, which were to give top priority to the personal rather than the mechanical qualities of technologically based instruction.

In general, Round 2 confirmed the findings of Round 1 which showed that higher levels of student participation in learning activities and greater appreciation of the course experience was possible using the expanded asynchronous methods. More importantly, the Round 2 experience began to highlight the importance of the personal qualities of the instructor as a determiner of success. This seemingly obvious finding tends to be factored out in technology applications as a neutral variable, but in this research, the main themes of which were to maintain social presence and immediacy, the personal factor could not be ignored. We have come to believe that research in this direction is important. In an online world in which personal qualities are critical to credibility and acceptance, the age-old tacit assumption of the generic instructor as a moot variable can no longer be accepted. The personal qualities of the instructor do matter, and we should learn how to capitalize on this realization as deliberately as we have capitalized on hardware and software technologies with charismatic properties.

Research Round 3

The increased importance of the personal factor became the basis for the research question for Round 3, which was whether the guidelines and procedures that produced positive results in the first two rounds of research in the hands of their inventor were portable to other instructors. During this round, a new instructor was trained in the asynchronous video system and completed a semester of instruction using the system. The course syllabus for Round 3 was based on the syllabus from Round 2. No major changes were planned, though circumstances unique to Round 3 would eventually require some adaptations. Data collected during Round 3 came from class artifacts, instructor and student interviews, instructor and researcher journals, student ratings data, and peer-reviewed inductive and deductive analysis of qualitative data.

Prior to Round 3, lessons learned from previous rounds and additional new theory sources were consolidated into the existing theory base to produce an asynchronous video learning model (AVLM) which attempted to capture the essential active ingredients of asynchronous video teaching. Round 3 research was also focused on testing the validity of this model.

The AVLM

An initial version of the AVLM began to evolve during Round 2 as a means of collecting the disparate threads of the theory base and consolidating them into a domain theory of limited scope to guide the design of asynchronous learning applications—particularly, applications for which the priority qualities were interpersonal rather than technological. The AVLM was an attempt to capture the essentials—the operational principles—for such designs that might make them portable to others.

The theory base for Round 2 had consisted of COI (community of inquiry) principles. Round 3 added to these the set of seven principles for good practice in undergraduate education published by the American Association for Higher Education, the Education Commission of the States, and the Johnson Foundation (Chickering and Gamson 1987). These principles were also applied at the outset of Round 3 with the COI principles, along with the first version of the AVLM.

The COI framework contribution was mainly in the area of creating social presence, which Arbaugh et al. (2007) describe as "the ability of participants to identify with the community (e.g., course of study), communicate purposefully in a trusting environment, and develop interpersonal relationships by way of projecting their individual personalities" (p. 4). The COI framework describes social presence under three headings: (a) affective expression, the expressing and receiving of emotions usually expressed in conditions of close proximity; (b) open communication, consisting of respectful and reciprocal exchanges; and (c) group cohesion, perception of self as part of a group.

Chickering and Gamson (1987) identify seven principles for good practice in undergraduate education:

- Good practice encourages contact between students and faculty.
- Good practice develops reciprocity and cooperation among students.
- Good practice encourages active learning.
- Good practice gives prompt feedback.
- Good practice emphasizes time on task.
- Good practice communicates high expectations.
- Good practice respects diverse talents and ways of learning.

The initial version of the AVLM used the relevant dimensions of the COI framework and the seven principles as scaffolds for forming a more application-oriented model for the design of asynchronous video instruction (see Griffiths 2010). The AVLM includes the following high-level design qualities that are operationalized through the expression of specific criteria:

- A mentoring and character-building relationship with high expectations
  - Students get to know the instructor, the objectives, and the expectations.
  - Students know that a real person exists who will act as a mentor.
  - The instructor gets to know students as individuals.
  - Students know that the instructor listens and recognizes them as individuals.
  - Students understand that the learning experience is more than just content.
- Visual–oral presentations as part of a variety of assignment types
  - Students are required to be actively engaged if they make visual–oral responses.
  - Visual–oral presentations added to hands-on and written work represent good variety.
- Rapid, individualized, learner-centered feedback

  - Instructors see student progress better through video clips than written assignments.
  - Rapid, relevant feedback better addresses misconceptions and errors.

- Collaborative learning with expert guidance/input

  - Students should feel they are part of a learning community in which they are valued.
  - Instructor guides the learning experience and injects instruction where appropriate.

- Continuing communication and support for motivation to fulfill requirements

  - Students are reminded and motivated to stay on track.
  - Students understand time allocation requirements for assignments.
  - Students see instructor regularly and especially when struggling.

Research data from Round 3 confirmed results from the previous rounds and gave insights into the effectiveness of the AVLM. The data also revealed qualities of the use of AVLM that were not directly related to the informing theory base:

Unexpected Levels of Enthusiasm for Discussion/Participation. The content of student videos and comments during interviews showed an unexpected enthusiasm for making the presentations. Students indicated in interviews that they enjoyed being able to express themselves verbally, saying that they felt they were better at expressing themselves verbally than in writing. Many student video presentations were longer than they were required to be, and most videos showed that students energetically shared their ideas and answers to assignment questions.

Instructor's Knowledge of Students Greater than Expected. A natural consequence of the AVLM design theory is that the instructor sees individual video presentations from every student many times in a semester. The instructor of the Round 3 course said that that because she saw the students individually in their video essays, and because she could review the videos, she was better able to get to know them and monitor their level of progress than she was with the students in her face-to-face class during the same semester. This ability to better observe and attend to students and to give them better feedback would appear to be a great strength of the AVLM.

Student-Perceived Value of Individual Feedback from Instructor. Implementing AVLM leads to students receiving detailed feedback for each assignment. In face-to-face classes, students come to expect less detailed responses from the instructor. In interviews during Round 3, students said that they especially enjoyed receiving more detailed information than they would have normally received.

The Impact of Round 3 on the AVLM

The results of the study in Round 3 led to the modification and addition of the following principles in the AVLM:

- Allow students to introduce themselves to each other as well as to the instructor.
- Include more videos from the instructor that give students a more complete knowledge of each others' personality and experiences.
- Messages from the instructor at the beginning of a semester must clearly convey the willingness of the instructor to help and also how and when students should seek support.
- Provide more opportunities for the instructor to show care and build connections with students.
- Provide assignments that are better designed to elicit genuine expressions from the students.
- Provide better opportunities for students to share information with one another.
- Provide students more opportunities to give feedback (obligatory and optional) to each other.
- Provide more opportunities for students to provide recognition through video and also watch the recognitions that are given.

Additional new principles incorporated into the AVLM design theory included:

- The principle of summarizing assignments or certain parts of a course.
- The principle of scheduled formative progress reports in video-mail format.
- The inclusion of peer review as a core principle.

Other Lessons Learned

In this round of research, the pedagogical design created a strong connection between the students and the instructor but did not take advantage of all of the available opportunities for forming connections between students. Student viewing of introductory videos was not made mandatory, so many students did not get to know each other until late in the semester. Though the instructor responded to each of the students individually, students felt that their relationship was mainly with the instructor and not with other students. A class discussion was conducted with the requirement that each student make a video and then watch the videos of two earlier submissions by classmates. Though the discussion did generate threads, and though students were enthusiastic about their ideas, the discussion format did not provide an opportunity for all members to contribute freely, and comments seemed more to be directed to the instructor about classmates rather than to the classmates themselves.

Significantly, however, students did comment on the conversational tone they sensed in their assignment submissions, indicating that since the learner–instructor connection worked very well, the lack of learner–learner connection was an artifact of this implementation, not of the AVLM principles. It became apparent during the data analysis that the structuring of assignments, the allocation of roles and responsibilities, and the setting of expectations are key factors in successful student–student communication. Where in the live classroom less-structured processes are common and can be made successful by a handful of regular contributors to conversations, in the online environment they cannot. This is most likely attributable to the fact that students can "hide" in live classes and simply become lurkers in the conversation, whereas in an AVLM class, every student receives due diligence, and the instructor feels more obligated to record and account student–student and student–instructor communications.

A major finding of Round 3 was the confirmation of the relationship between instructor personality and the perceived experience of the learner. Recall that in Round 3, the instructor was new. Though the evaluation of the course by students was high as expected, and higher than the evaluations for the face-to-face classroom instruction, a slightly larger number of learners expressed comments in this round indicating that adjustments had to be made to work with the instructor's personality. In retrospect, this finding is not surprising at all. We readily acknowledge the influence of the personal qualities of an instructor in face-to-face classrooms. What became apparent in Round 3 is that if design targets like those defined on Krippendorff's trajectory are to become more the rule, then the deliberate selection of the personal qualities of key visible personalities may become a common practice. In this light, Krippendorff's design method called "(re-)defining the characteristics of artifacts" becomes important, and the study of personal qualities of event leaders and moderators may become vital.

Conclusions

The research program described in this chapter continues today on a larger scale exploring: (a) variables introduced by individual instructor personality, (b) effects of increased learner–learner interaction, (c) the nature of infrastructure and tools for handling video conversational exchanges, (d) the upper limits of scalability afforded by AVLM principles, and (e) the practical sustainability of the instructional style embodied in AVLM principles. Though the trail of bread crumbs so far has led to the importance of the instructor–learner relationship and the personal qualities of the instructor, it is uncertain which qualities will be shown to have the most long-lasting and commitment-prolonging effects on learners. It is our conviction that the path will lead to other, deeper underlying issues related to the ability to form relationships of trust. The most relevant qualities in the end may not be those of charismatic personalities as much as a blend of the ability to show appreciation and acceptance, to give proper recognition for progress, to support the setting of high expectations, and to show respect for personal choices of learners. These may become the criteria for the instructor role in the design of distance education in the future.

References

Arbaugh, J. B., Cleveland-Innes, M., Diaz, S., Garrison, D. R., Ice, P., Richardson, J., et al. (2007). *Community of inquiry framework: Validation and instrument development*. In 13th Annual Sloan-C Conference, Orlando, FL.

Barab, S., & Squire, K. (Eds.). (2004). Design-based research: Putting a stake into the ground [Special issue]. *Journal of the Learning Sciences*, *13*(1).

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences, 2*(2), 141–178.

Chickering, A., & Gamson, Z. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin, 39*(7), 3–7.

Dede, C. (2005). Why design-based research is both important and difficult [Special issue]. *Educational Technology, 45*(1), 5–8.

Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*(2–3), 87–105.

Gibbons, A. S. (2003). What and how do designers design: A theory of design structure. *Technology Trends, 47*(5), 22–27.

Gibbons, A. S., & Rogers, P. C. (2009). The architecture of instructional theory. In C. M. Reigeluth & A. A. Carr-Chellman (Eds.), *Instructional-design theories and models, Volume III: Building a common knowledge base* (pp. 305–326). New York: Routledge.

Griffiths, M. (2011). *Improving the asynchronous learning model*. Unpublished doctoral dissertation, Brigham Young University. Retrieved Dec 15, 2011, from http://contentdm.lib.byu.edu/cgi-bin/showfile.exe?CISOROOT=/ETD&CISOPTR=2074&filename=etd3518.pdf.

Griffiths, M. E., & Graham, C. R. (2009). Using asynchronous video in online classes: Results from a pilot study. *Instructional Technology and Distance Education, 6*(3), 65–76.

Kelly, A. E. (2003). The role of design in educational research [Special issue]. *Educational Researcher, 32*(1).

Kelly, A. E., Lesh, R., & Baek, J. (Eds.). (2008). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. New York: Routledge.

Krippendorff, K. (2006). *The semantic turn: A new foundation for design*. New York: CRC.

Reigeluth, C. M., & Frick, T. W. (1999). Formative research: A methodology for improving design theories. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory, Volume II*. Hillsdale: Lawrence Erlbaum.

Sandoval, W. A., & Bell, P. (Eds.). (2004). Design-based research methods for studying learning in context [Special Issue]. *Educational Psychologist, 39*(4).

Van den Akker, J., Gravemeijer, K., McKenney, S., & Nieveen, N. (2006). *Educational design research*. New York: Routledge.

Interaction in Distance Education and Online Learning: Using Evidence and Theory to Improve Practice

Philip C. Abrami, Robert M. Bernard, Eva M. Bures, Eugene Borokhovski, and Rana M. Tamim

Introduction

This chapter provides us with an opportunity to look backward as a way of looking forward. As reviewers of evidence, we constantly use the past record of evidence to summarize what is known, to offer new insights about the existing evidence and then to suggest what may lie ahead in theorizing, researching, and applying new knowledge. Distance education and online learning provide exciting opportunities for not only increasing the reach of education and reducing its cost, but also, most important to us, for increasing the quality of teaching and learning. In looking forward, we combine the results of our latest distance education review with summaries of evidence from other areas to suggest directions for the future.

Thus, this chapter has two intertwined foci. One is at the level of research, where we will argue that distance education (DE) and online learning (OL) have evolved beyond simple comparisons with classroom instruction. The other is at the level of design, where we will suggest how theory and new forms of evidence may improve instructional practice.

P.C. Abrami, Ph.D (✉) • R.M. Bernard, Ph.D • E. Borokhovski, Ph.D
Centre for the Study of Learning and Performance, Concordia University,
1455 de Maisonneuve Blvd. West, Montreal, QC, Canada, H3G 1 M8
e-mail: abrami@education.concordia.ca

E.M. Bures, Ph.D
School of Education, Bishop's University, 2600 College Street, Sherbrooke, QC, Canada, J1M 1Z7

R.M. Tamim, Ph.D
School of e-Education, Hamdan Bin Mohammed e-University, Dubai, UAE

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The Research Paradigm of the Past

An examination of the quantitative/experimental research literature of DE and OL reveals an inordinately large proportion of comparisons with classroom instruction (CI). Bernard et al. (2004a, b) found that 232 such studies were conducted between 1985 and 2003. Many others have been done since 2003. Why is this form of primary study so popular? The most cynical answer to this question is that they are easy to conduct, given that many universities and colleges have routinely run parallel forms of courses, one as a conventional classroom-based section and the other as a DE section. From a less cynical perspective, they are sometimes used to justify the viability of DE as an alternative to classroom instruction to administrators and policymakers. If asked a second question, whether researchers interested in improving classroom instruction would make similar comparisons with DE and OL, the resounding answer would be "no."

Since 2000, there have been more that 15 meta-analyses of this literature. Some have focused on particular populations, such as K-12 students (e.g., Cavanaugh et al. 2004), postsecondary students (e.g., Jahng et al. 2007), and healthcare professionals (e.g., Cook et al. 2008). Some have addressed particular forms of DE (telecourses, Machtmes and Asher 2000; online learning, U.S. DOE 2009; and Web-based instruction, Sitzmann et al. 2006), and some have looked at specific outcome measures besides achievement (satisfaction, Allen et al. 2002). The meta-analysis by Bernard et al. (2004a, b) looked at all of these population features and also examined studies reporting dropout statistics. What has been the overall outcome of all of this primary research and meta-analytic activity based upon it?

1. There is general consensus of the effectiveness of all forms of DE (including online learning and Web-based instruction) compared with classroom instruction.
2. There is wide variability among studies, from those strongly favoring DE to those favoring CI, thereby bringing into question the unqualified interpretation of point 1.
3. There is a tendency for researchers to describe the DE/OL condition in great detail while characterizing the CI condition as "traditional classroom instruction," thereby diminishing the opportunity to describe and compare salient study features.
4. Comparative primary research is plagued with a variety of methodological problems and confounds that make them very hard to interpret (Bernard et al. 2004a, b).
5. There is little else to learn about the nature of DE or CI from comparative studies.

The Next Generation of Research

More recent advances in technology have increased the power, flexibility, ubiquity, and ease of learning online and at a distance. As one consequence, there is literature in DE and OL, albeit small by comparison to the DE vs. CI literature, that compares

DE treatments "head-to-head." Bernard et al. (2009) examined this literature from the perspective of interaction treatments (i.e., conditions of media and/or instructional design that are intended to enable and/or increase student–student, student–instructor, and student–content interaction). According to Cook (2009), it is studies such as these that will help us understand "… when to use e-learning (studies exploring strengths and weaknesses) and how to use it effectively (head-to-head comparisons of e-learning interventions)" (p. 158). Similarly, Bernard et al. (2009) argue that it is through direct studies of DE and OL that "… progress to advance theory and practice will be made as researchers begin to examine how instructional and technological treatments differ between DE conditions, not between DE and CI" (p. 1262). As early as 2000, Clark (2000) was arguing the same point, "All evaluations [of DE] should explicitly investigate the relative benefits of two different but compatible types of DE technologies found in every DE program" (p. 4).

Prior to Bernard et al. (2009), other reviews, and the studies on which they were based, explored only indirect comparisons of pedagogical features across studies by contrasting DE with CI. However, differentiating among critical DE features is never certain in such contrasts and may be explained by a host of alternative factors. In contrast, more recent DE vs. DE studies allow for the direct comparison of pedagogical features, such that differentiating among critical features is more certain and may be explained by fewer alternative factors.

Furthermore, as Bernard et al. (2009) demonstrated, it is not always necessary for primary studies of DE and OL to directly address instructional variables such as interaction, flexibility, technology affordance, etc., in order for a systematic review to be conducted. It is necessary, however, that a conceptual structure be devised into which primary studies can be reasonably integrated. That is, one or more underlying constructs must be identified, allowing for different study-by-study operationalizations to be classed together by the reviewer.

But these studies, especially high-quality studies, still represent the minority. A fundamental shift in the culture of research practices and the quality of reporting needs to occur to enable systematic reviewers and meta-analysts to come to broader and more comprehensive generalizations about the processes and conditions under which learning is best supported in DE and OL course designs. These include:

- *More research* that compares at least one DE/OL treatment to another DE/OL treatment with an emphasis on learning and motivational processes
- *Better research designs* (if not RCTs, designs that at least control for selection bias)
- *More studies* across the grade levels (k-12) and in higher education settings of all types
- *Better-quality descriptions of all treatment levels* and how well they were implemented
- *Better-quality measures*, particularly measures of student learning, higher-order thinking, and engagement
- *Better-quality reporting*, preferably the inclusion of full descriptive statistics

This is a hope, perhaps more like a plea, for the future. But there is much to be learned already from studies that do compare DE/OL conditions directly. In order to do so, Bernard et al. (2009) used Moore's (1989) tripartite conception of interaction in DE and Anderson's (2003) more recent expansion on the conditions that encourage student–student, student–instructor, and student–content interaction to examine both the magnitude and the strength of interaction treatments.

Interaction in DE and OL

The DE/OL literature is largely univocal about the importance of interaction (Lou et al. 2006; Anderson 2003; Sutton 2001; Muirhead 2001a, b; Sims 1999; Wagner 1994; Fulford and Zhang 1993; Jaspers 1991; Bates 1990; Juler 1990; Moore 1989; Daniel and Marquis 1979, 1988; Laurillard 1997). This is because of the integral role that interaction between students, teachers, and content is presumed to play in all of formal education (e.g., Garrison and Shale 1990; Chickering and Gamson 1987) and because interaction was largely absent during so much of the early history of DE (Nipper 1989). But is there empirical evidence that interaction is important and what forms of interaction are best? Bernard et al. (2009) were able to synthesize the evidence in support of this belief in a meta-analysis that summarized findings from 74 empirical studies comparing different modes of DE to one another. They found the overall positive weighted average effect size of 0.38 for achievement outcomes favoring more interactive treatments over less interactive ones. The results supported the importance of three types of interaction: among students, between the instructor and students, and between students and course content.

Types of Interaction

An interaction is commonly understood as actions among individuals, but this meaning is extended here to include individual interactions with curricular content. Moore (1989) distinguished among three forms of interaction in DE: (1) student–student interaction, (2) student–instructor interaction, and (3) student–content interaction.

Student–student interaction refers to interaction among individual students or among students working in small groups (Moore 1989). In correspondence courses, this interaction is often absent; in fact, correspondence students may not even be aware that other students are taking the same course. In later generations of DE, including two-way video- and audioconferencing and Web-based courses, student–student interaction could be synchronous, as in videoconferencing and chatting, or asynchronous, as in discussion boards or e-mail messaging.

Student–instructor interaction focuses on dialogue between students and the instructor. According to Moore (1989), during student–instructor interaction, the instructor seeks "to stimulate or at least maintain the student's interest in what is to be taught, to motivate the student to learn, to enhance and maintain the learner's interest, including self-direction and self-motivation" (p. 2). In DE environments, student–instructor interaction may be synchronous such as through the telephone, videoconferencing, and chats, or asynchronous such as through correspondence, e-mail, and discussion boards.

Student–content interaction refers to students interacting with the subject matter under study to construct meaning, relate it to personal knowledge, and apply it to problem-solving. Moore (1989) described student–content interaction as "… the process of intellectually interacting with the content that results in changes in the learner's understanding, the learner's perspective, or the cognitive structures of the learner's mind" (p. 2). Student–content interaction may include reading informational texts for meaning, using study guides, watching instructional videos, interacting with multimedia, participating in simulations, or using cognitive support software (e.g., statistical software), as well as searching for information, completing assignments, and working on projects.

The Positive Impacts of Interaction

The results of Bernard et al. (2009) confirmed the importance of each type of interaction on student learning. See Table 1 for a summary of the results. Each type of interaction had a significantly positive average effect size ranging from +0.32 for student–instructor interaction to +0.49 for student–student interaction. Both student–student and student–content interactions were significantly higher than student–instructor interaction.

Not surprisingly, the major conclusion from Bernard et al. (2009) was that designing interaction treatments into DE courses, whether to increase interaction with the material to be learned, with the course instructor, or with peers impacts positively on student learning. But are even larger and more consistently positive effects possible? It may be that the presence of the interaction conditions in the reviewed studies functioned in exactly the way they were intended so that the estimates of the effects were fairly accurate. But just because opportunities for interaction were offered to students does not mean that students availed themselves of them, or if they did interact, that they did so effectively. The latter case is the more likely event, so the achievement effects resulting from well-implemented interaction conditions may be underestimated in our review.

Table 1 Weighted average achievement effect sizes for categories of interaction

Interaction categories	k	$g+$(adj.)	SE
Student–student (SS)	10	0.49	0.08
Student–instructor (SI)	44	0.32	0.04
Student–content (SC)	20	0.46	0.05
Total	74	0.38	0.03
(Q) Between-class		7.05*	

Therefore, we believe that what we identified in Bernard et al. (2009) is the impact of the first generation of interactive distance education (IDE1), where online learning instructional design and technology treatments allowed or enabled some degree of interaction to occur. In other words, in IDE1 learners were able to interact but may not have done so optimally given the quality and quantity of interactions that occurred. These interactions may have been limited by how the courses used in the research were designed and delivered and limited by how technology mediated learning and instruction.

Consequently, the next generation of interactive distance education (IDE2), or purposeful, interactive distance education, should be better designed to facilitate interactions that are more targeted, intentional, and engaging. Not only will we need knowledge tools and instructional designs that do this effectively, but we will also need research that validates both the underlying processes (e.g., using implementation checks and measures of treatment integrity) as well as the outcomes of IDE2 (e.g., especially measures of student learning).

The Next Generation of Interactive Distance Education (IDE2)

One way to advance this new, more interactive DE, largely possible because of Web 2.0 features, is via the development of specialized knowledge tools or customized instructional designs that take advantage of these new features. A knowledge tool is educational software that scaffolds and supports student learning. Instructional design is the practice of maximizing the effectiveness, efficiency, and appeal of instruction and other learning experiences. Effective knowledge tools for IDE2 should be based on sound instructional design or allow instructional design templates to be added to them.

Beldarrain (2006) notes that although emerging technologies offer a vast range of opportunities for promoting collaboration in learning environments, distance education programs around the globe face challenges that may limit or deter implementation of these technologies. Beldarrain (2008), like Moore (1989), believes that instructional design models must be adapted to integrate various types of interactions, each with a specific purpose and intended outcome. It is also necessary to choose the appropriate technology tools that foster collaboration, communication, and cognition. Furthermore, instructional design models must anchor student interaction in the instructional objectives and strategies that create, support, and enhance learning environments. Beldarrain (2008) explores five instructional design frameworks and assesses their effectiveness in integrating interaction as part of the design and development phase of DE. She also provides literature-based suggestions for enhancing the ability of these design frameworks to foster student interaction.

Guided, focused, and purposeful interaction goes beyond whether opportunities for interaction exist to consider especially why and how interaction occurs. When students consider *why* they engage in learning activities, they are reflecting on their motivation (from the Latin word “movere” meaning to move) for learning including the energy of activity and the direction of that energy toward a goal. When students consider *how* they engage in learning, they are addressing the strategies and techniques for knowledge acquisition.

Evidence-Based Approaches to IDE2

We highlight below several evidence-based approaches useful in the next generation of IDE2. These include application of (1) theories of self-regulation, (2) multimedia learning principles, (3) motivational design principles, and (4) collaborative and cooperative learning principles. We also discuss challenges in integrating these principles in IDE2 and the instructional designs and learning tools best suited for its success.

Self-Regulation Principles

One important interpretation of purposeful interaction in IDE2 means learners will be self-regulated; they will set clear goals and develop strategies for achieving those goals, monitor their activity, and reflect on their accomplishments using both self and peer or teacher feedback (Zimmerman 2000). Self-regulated learners are individuals who are metacognitively, motivationally, and behaviorally active participants in their own learning and consequently are learners whose academic performance is higher than others (Zimmerman 2000). A main feature of self-regulated learning is metacognition, which refers to the awareness, knowledge, and control of cognition. The three processes that make up metacognitive self-regulation are planning, monitoring, and regulating. Proponents of socio-cognitive models emphasize that to develop effective self-regulated learning strategies, "students need to be involved in complex meaningful tasks, choosing the products and processes that will be evaluated, modifying tasks and assessment criteria to attain an optimal challenge, obtaining support from peers and evaluating their own work" (Perry 1998, p. 716).

The three cyclical phases of self-regulation include both metacognitive and motivational components, providing the foundation for better sustainability of learning and skill development. The forethought phase includes task analysis (goal setting and strategic planning) and consideration of self-motivation beliefs (self-efficacy, outcome expectations, intrinsic interest/value, and goal orientation). Learners need to set goals and make plans to engage successfully in the task as well as take stock of their own motivation toward the task. The next phase, the performance phase, includes self-control (self-instruction, imagery, attention focusing, and task strategies) and self-observation (self-recording and self-experimentation). Learners need to engage in the activity, controlling their processes, and observe their own performance. Finally, the self-reflection phase includes self-judgment (self-evaluation and casual attribution) and self-reaction (self-satisfaction/affect and adaptive–defensive

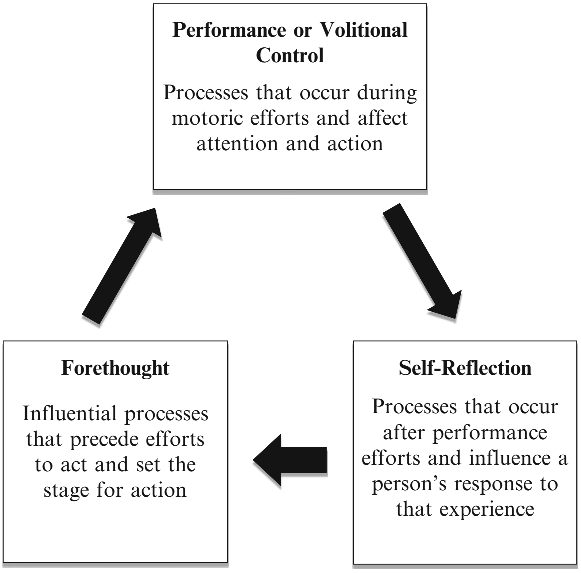

Fig. 1 Zimmerman's (2000) cyclical model of self-regulation

responses) (Zimmerman 2000). Here learners examine themselves and develop motivational "responses" or reactions (see Fig. 1). Zimmerman (2008) emphasizes the importance of directing further research at the motivational aspects of self-regulation and Zimmerman and Tsikalas (2005) discuss how student motivational beliefs need to be an integral part of the design of educational software.

Though the terms are different, distance education has emphasized the need for students to be self-directed and to learn how to learn; historically, this emphasis comes from the adult learning literature as early models of distance education largely catered to older learners. There is an emphasis on adults directing their own learning in a myriad of ways from monitoring their progress to setting their own learning goals. Knowles (1980) outlined six key principles of his adult learning theory, two of which address adult learners' self-regulation: learners need to be aware of the learning process to be undertaken, where that process leads (the learning which will be achieved), and why the learning is important; they also need to be self-directed in their learning, taking ownership over the methods and goals of learning. Similarly, Brookfield (1995) discusses adult learners' needs to be self-directed, as illustrated by setting up goals, finding relevant resources, and evaluating their own progress and the importance of supporting adults in learning how to learn. Such approaches have been criticized for placing too much emphasis on the individual, as has the concept of self-regulation. Hickey and McCaslin (2001) suggest that reconciliation with more of a socio-constructivist perspective would not necessarily prohibit the concept of self-regulation, but it would be framed within the context of learners increasing their engagement in communities of practice.

It is possible to create instructional designs with many of the features of self-regulation and to embed these designs as templates into existing tools for distance and online learning, especially those that are intended to support computer conferencing (e.g., FirstClass). But knowledge tools are emerging, designed specifically to promote student self-regulation in blended, online, and distance learning contexts. ePEARL, an electronic portfolio software that serves to support learning processes and encourage self-regulated learning, is one such tool (Abrami et al. 2008; Meyer et al. 2010).

Multimedia Learning Principles

Research on learning from multimedia has lead to the development of instructional design principles by Mayer (2001, 2008) that have applications to IDE2. In a classic experiment, Paivio (1969) found that subjects who were shown a rapid sequence of pictures as well as a rapid sequence of words and later asked to recall the words and pictures, either in order of appearance or in any order they wanted, were better at recalling images when allowed to do so in any order. Participants, however, more readily recalled the sequential order of the words, rather than the sequence of pictures. These results supported Paivio's hypothesis that verbal information is processed differently than visual information.

Paivio's dual-coding theory of information processing (1971, 1986) gives weight to both verbal and nonverbal processing. The theory posits that there are two cognitive subsystems, one specialized for the representation and processing of nonverbal objects/events (i.e., imagery) and the other specialized for dealing with language.

Following from this pioneering work, Mayer (2001, 2008) describes a cognitive theory of multimedia learning organized around three core principles: (1) dual channels—the idea that humans possess separate channels for processing visual and verbal material; (2) limited capacity—the idea that each channel can process only a limited amount of material at any one time; and (3) active processing—the idea that deep learning depends on the learner's cognitive processing during learning (e.g., selecting, organizing, and integrating).

According to Mayer (2001, 2008), the central challenge of instructional design for multimedia learning is to encourage learners to engage in appropriate cognitive processing during learning while not overloading the processing capacity of the verbal or visual channel. Accordingly, Mayer (2001, 2008) summarizes a series of evidence-based principles for the design of multimedia learning tools that are relevant to IDE2.

There are five principles for reducing extraneous processing and the waste of cognitive capacity, three principles for managing essential processing and reducing complexity, and two principles for fostering generative processing and encouraging the use of cognitive capacity. These evidence-based principles are listed in Table 2. For example, the five principles for reducing extraneous processing include coherence, signaling, redundancy, spatial contiguity, and temporal contiguity. All of these principles are intended to focus the learner's attention and processing of information and avoid distractions or spurious mental activity leading to cognitive overload.

Table 2 Mayer's (2001, 2008) multimedia learning design principles

Principle	Definition
Five evidence-based and theoretically grounded principles for reducing extraneous processing	
Coherence	Reduce extraneous material
Signaling	Highlight essential material
Redundancy	Do not add on-screen text to narrated animation
Spatial contiguity	Place printed words next to corresponding graphics
Temporal contiguity	Present corresponding narration and animation at the same time
Three evidence-based and theoretically grounded principles for managing essential processing	
Segmenting	Present animation in learner-paced segments
Pretraining	Provide pretraining in the name, location, and characteristics of key components
Modality	Present words as spoken text rather than printed text
Two evidence-based and theoretically grounded principles for fostering generative processing	
Multimedia	Present words and pictures rather than words alone
Personalization	Present words in conversational style rather than formal style

By using the evidence-based principles of multimedia learning, interaction between students and the course content, in particular, will be enhanced by going beyond the mere inclusion of interactive multimedia in DE and OL courses. These evidence-based principles help insure that learning from multimedia will be meaningful, maximizing the storage or construction of knowledge and its retrieval.

Motivational Design Principles

Beyond self-regulation, motivational principles in general are also important in IDE2 to insure the active and directed engagement of learners. In an enlightening article, Fishman et al. (2004) acknowledged that far too few cognitively based or constructively oriented knowledge tools are in wide use in school systems. The primary uses of educational technology remain drill and practice, word processing, and Web surfing (Burns and Ungerleider 2003), whereas the most helpful for learning appear to be technologies that offer students various forms of cognitive support (e.g., Schmid et al. 2009). Fishman et al. (2004) claim that we need to understand ways to encourage instructor and student "buy in" or accept the value and purpose of the innovation. For example, Wozney et al. (2006) used expectancy theory to explain teacher integration of technology. Expectations of success, the perceived value of outcomes, vs. the costs of adoption were key factors in explaining teacher adoption and persistence. Finally, Moos and Azevedo (2009) summarized evidence on the positive association between students' computer self-efficacy beliefs and learning with educational software.

These perspectives and findings about student and educator motivation and the use of educational software overlap with motivational principles for instructional design in general. Pintrich (2003) provided five motivational generalizations and 14 instructional design principles that are evidence-based. The motivational

Table 3 Motivational generalizations and design principles (Pintrich 2003)

Motivational generalization	Design principle
Adaptive self-efficacy and competence beliefs motivate students	• Provide clear and accurate feedback regarding competence and self-efficacy, focusing on the development of competence, expertise, and skill • Design tasks that offer opportunities to be successful but also challenge students
Adaptive attributions and control beliefs motivate students	• Provide feedback that stresses process nature of learning, including importance of effort, strategies, and potential self-control of learning • Provide opportunities to exercise some choice and control • Build supportive and caring personal relationships in the community of learners in the classroom
Higher levels of interest and intrinsic motivation motivate students	• Provide stimulating and interesting tasks, activities, and materials, including some novelty and variety in tasks and activities • Provide content material and tasks that are personally meaningful and interesting to students • Display and model interest and involvement in the content and activities
Higher levels of value motivate students	• Provide tasks, material, and activities that are relevant and useful to students, allowing for some personal identification with school • Classroom discourse should focus on importance and utility of content and activities
Goals motivate and direct students	• Use organizational and management structures that encourage personal and social responsibility and provide a safe, comfortable, and predictable environment • Use cooperative and collaborative groups to allow for opportunities to attain both social and academic goals • Classroom discourse should focus on mastery, learning, and understanding course and lesson content • Use task, reward, and evaluation structures that promote mastery, learning, effort, progress, and self-improvement standards and less reliance on social comparison or norm-referenced standards

generalizations are (1) adaptive self-efficacy and competence beliefs motivate students, (2) adaptive attributions and control beliefs motivate students, (3) higher levels of interest and intrinsic motivation motivate students, (4) higher levels of value motivate students, and (5) goals motivate and direct students (see Table 3).

For example, to encourage self-efficacy and student competency beliefs means distance and online courses need to be structured to (1) provide clear and accurate feedback regarding competence and self-efficacy, focusing on the development of competence, expertise, and skill; and (2) offer opportunities to be successful but also challenge students. To maximize students' values for learning, course content requires (1) tasks, material, and activities that are relevant and useful to students, allowing for some personal identification with school and the content to be learned; and (2) discourse that focuses on the importance and utility of content and activities.

An important reason to use a knowledge tool occurs when learners are undertaking large, novel, or difficult tasks rather than trivial or routine ones. Knowledge tools may be best suited to situations when learners have to be conscientiously engaged in learning, when the outcome is important, and/or when the process is being judged or evaluated. Knowledge tools are also suited to situations when the outcome is uncertain and especially when student effort matters and/or when failure has occurred previously. One ideal situation is where a knowledge tool is integrated into instruction, where the task is complex and novel, where the learner wants to do well and doing well is important, and when the student is not certain how well she/he will do but believes that personal efforts to learn will lead to success.

Collaborative and Cooperative Learning Principles

When student–student interaction becomes truly collaborative and learners work together to help each other learn, the benefits of interactivity may be largest. Lou et al. (2001) examined the effects of learning in small groups with technology and reached similar conclusions.

Lou et al.'s (2001) study quantitatively synthesized the empirical research on the effects of social context (i.e., small group vs. individual learning) when students learn using computer technology. In total, 486 independent findings were extracted from 122 studies involving 11,317 learners. The results indicated that, on average, small group learning had significantly more positive effects than individual learning on student individual achievement (average ES = +0.15), group task performance (average ES = +0.31), and several process and affective outcomes. The effects of small group learning were significantly enhanced when (1) students had group work experience or instruction; (2) specific cooperative learning strategies were employed; (3) group size was small; (4) using tutorials or practice software or programming languages; (5) learning computer skills, social sciences, and other subjects such as management and social studies; and (6) students were either relatively low in ability or relatively high in ability.

Lou et al. (2001) suggested that prior group learning experience and the teacher's use of cooperative learning strategies are important pedagogical factors that may influence how much students learn when working in small groups using technology. Explanations of group dynamics suggest that not all groups function well; for example, groups often do not function well when some members exert only minimal effort. Students need practice working together on group activities and training in how to work collaboratively. In IDE2, this training can be done in numerous ways including via the incorporation of multimedia vignettes. Experience in IDE2 group work may also enable members to use acquired strategies for effective group work more effectively.

Specific instruction for cooperative learning in IDE2 ensures that students learning in small groups will have positive interdependence as well as individual accountability (Abrami et al. 1995). Positive interdependence among outcomes, means, or interpersonal factors exists when one student's success positively influences the chances of other students' successes. According to Abrami et al. (1995), positive interdependence develops along a continuum from teacher-structured interdependence, followed by student perceptions of interdependence, leading to student interdependence behaviors and culminating in student interdependence values.

Individual accountability among outcomes, means, and interpersonal factors involves two components: (1) each student is responsible for his or her own learning and (2) each student is responsible for helping the other group members learn. Like positive interdependence, individual accountability develops along a continuum from teacher-imposed structure to accountability as a student value.

Recently, Johnson and Johnson (2009) updated their review of the evidence on cooperative learning noting that the research in the area has been voluminous numbering in excess of 1,200 studies. They elaborated on the importance of not only positive interdependence and individual accountability but also promotive interactions. Promotive interactions occur as individuals encourage and facilitate each other's efforts to accomplish the group's goals. Promotive interaction is characterized by individuals: (1) acting in trusting and trustworthy ways; (2) exchanging needed resources, such as information and materials, and processing information more efficiently and effectively; (3) providing efficient and effective help and assistance to groupmates; (4) being motivated to strive for mutual benefit; (5) advocating exerting effort to achieve mutual goals; (6) having a moderate level of arousal, characterized by low anxiety and stress; (7) influencing each other's efforts to achieve the group's goals; (8) providing groupmates with feedback in order to improve their subsequent performance of assigned tasks and responsibilities; (9) challenging each other's reasoning and conclusions in order to promote higher-quality decision-making and greater creativity; and (10) taking the perspectives of others more accurately and thus being better able to explore different points of view.

Webb (Webb 1989, 2008; Webb and Mastergeorge 2006; Webb and Palincsar 1996) has examined extensively what constitutes effective collaboration in terms of how meaningful learning is exchanged. Ineffective collaboration includes providing correct answers without explanation. Effective collaboration includes giving and receiving elaborated explanations with a focus on encouraging understanding in others.

When designing online and distance learning, instructional designers should consider these four principles—(1) positive interdependence, (2) individual accountability, (3) promotive interactions, and (4) elaborated explanations. There are knowledge tools that can be designed to better scaffold and support aspects of collaborative and cooperative learning or, more generally, student–student interaction. And they may also be used to support student–content interaction and student–teacher interaction as well.

Challenges to IDE2

Abrami (2010) considered several reasons why learners do not better utilize some knowledge tools. The first is based on the principle of least effort. Even the best strategic learners need to balance efficiency concerns with effectiveness concerns, as well as balance proximal goals with distal ones. Strategic learners need to find the middle ground between how much they can learn and how well they can learn or between the quantity of learning and the quality of learning.

Second, strategic learners often have to find the balance between intrinsic interests and extrinsic requirements. Frankly, the postsecondary learning system imposes its own restrictions on students (e.g., course requirements) that may not make effortful strategies uniformly appropriate.

Third, decades ago, McClelland et al. (1953) illustrated the impact not only of individual differences in achievement strivings but also the importance of perceived outcome to learners' task choices and persistence. Years later, Weiner (1980) showed how causal attributions for task outcomes varied among learners, that these attributions affected thinking, behavior, and feelings and that attributions varied depending on subjective estimates of the likelihood of future success and, later, perceived outcome.

When we ask students to take personal responsibility for their own learning, we may create an internal conflict for students. First, does a student believe she/he can succeed at this learning task? Second, does a student believe that this tool will help him/her succeed? Third, does a student want to take responsibility for his/her own learning? While McClelland and Atkinson (e.g., McClelland et al. 1953) showed that high-need achievers are drawn to moderately challenging tasks, we know that high-need achievers tend to avoid tasks which are low in the probability of success. Weiner and others (e.g., Weiner 1980) showed that there are marked differences in causal attributions when learners perceive they have succeeded vs. failed. Attributional bias means learners attribute success to internal causes and failure to external ones. Defensive attributions for failure (e.g., I failed because the exam was too hard or my teacher did not help) help protect a learner's sense of self-efficacy (i.e., keep a learner from concluding she/he failed because of lack of ability).

Therefore, there may be situations where increased personal responsibility for learning is not always beneficial to a learner's achievement strivings, causal attributions, and self-efficacy. These situations have mostly to do with the learner's perception of the likelihood of future success and/or perceived outcome. For example, in novel or very demanding situations, especially ones that are high in importance, learners may want to avoid taking responsibility for their learning (and the learning of others) until such time as they are confident of a positive outcome. In other words, it is likely that some learners will return the responsibility for learning to the instructor or, more generally, the instructional delivery system, as accept it themselves.

Fourth, related to the above is the importance of effort–outcome covariation. Productive learners come to believe that their efforts at learning lead to successful learning outcomes. These learners come to believe that "the harder and more that I try, the more likely I am to achieve a positive learning outcome." The opposite belief is when a learner believes that their efforts bear little, if any, relationship to learning outcomes. In behavioral terms, this is learning that outcomes are noncontingent on actions, called learned helplessness by Seligman (1975). Seligman demonstrated that after experiencing these noncontingencies, learners made almost no effort to act even when the contingencies were changed. This passivity, even in the face of aversive stimuli, is difficult to reverse.

Fifth, in order to encourage active collaboration among learners, it is often necessary at the outset to impose external structures including individual accountability and positive interdependence. These structures insure that each learner knows that she/he is responsible for his/her own learning within a group and that she/he is also responsible for the learning of others, respectively. Eventually, the meaning and value of these structures become internalized and are no longer necessary to impose (Abrami et al. 1995).

However, not all tasks lend themselves equally well to collaboration or require team activity in the same fashion. Steiner's typology of tasks (1972) presents four major task types—additive, compensatory, disjunctive, and conjunctive. For example, Steiner claims that certain types of disjunctive tasks (e.g., questions involving yes/no or either/or answers) provide group performances that are only equal to or are less than the performance of the most capable group member. In contrast, additive tasks, where individual inputs are combined, provide group performances that are always better than the most capable group member. Cohen (1994) noted that true group tasks require resources that no single individual possesses so that no one is likely to solve the problem without input from others. In the absence of true group tasks and when individual accountability and positive interdependence are ill structured, learning in groups may see a reduction in individual effort, not an increase, colorfully referred to as "social loafing" (Latane et al. 1979). Indeed, Abrami et al. (1995) summarized ten factors that research showed are related to social loafing: size, equality of efforts, identifiability, responsibility, redundancy, involvement, cohesiveness, goals, heterogeneity, and time. Creating activities that accounts for the influence of these factors on group productivity and individual learning is a tall order. And it may be more difficult in an electronic learning environment where, for example, there is less identifiability (i.e., individual contributions that are clearly identified) and tasks where there is more redundancy (i.e., individuals who believe their contributions are not unique).

To summarize, the following factors may be at work in preventing more pervasive and persistent use of knowledge tools by students:

- Learners do not value the outcome(s) of learning sufficiently to increase their efforts to learn—it is not so important to do well.
- Learners believe that gains in learning from increased effort are inefficient—it takes too much effort to do a little bit better.
- Learners do not want to become more responsible for their own learning—it is too risky unless the perceived chances of a positive outcome are increased.
- Learners believe that novel approaches to learning (use of unfamiliar knowledge tools) increase the likelihood of poor outcomes, not increase them—it is not of interest or too risky because they do not believe the tool will help them learn.

There are ways to overcome these challenges. Several suggestions for future research and development follow.

First, knowledge tools must be structured so they increase the efficiency of learning as well as the effectiveness of learning. As such, instructional designers should pay more attention to *ease of use* as an overall design objective, where learners need even more guidance as to which features to use, how, and when. Time is one critical factor, and it may be dealt with in numerous ways including structuring how tool activities are carried out (e.g., weekly) or making them part of the evaluation scheme. Simplicity of use may be important; avoiding the addition of time to learn how to use technology at the expense of time needed to learn the content. It would be interesting to know not only whether use of each tool resulted in increased achievement but also whether the quality and quantity of use related to learning gains—a form of cost/benefit ratio.

Second, students need more guidance about *when to use* the tool and not only whether to use it. That is, the tool should be used when a learning task is both difficult and important. Advice and feedback from instructors may help, as well as queries and suggestions embedded in the tool. Not every learning task requires the use of a knowledge tool, and its use probably varies according to the skills and interests of each learner. Furthermore, even when a task warrants the use of a tool, not all features of the tool may need to be used. Some explanation, embedded within the tool, regarding when to use which feature would also be useful. As such, additional features should be designed to be used flexibly when appropriate to the learning task.

Third, like any tool, physical or cognitive, users need *practice* to use the tool well and wisely. You do not license a driver after 1 day's practice or ask a carpenter apprentice to build a cabinet after a single time using a band saw. Asking students to use a tool voluntarily where performance and grades matter is stacking the deck against enthusiastic use. Requiring use may ameliorate the problem because it is fair to everyone. Nevertheless, learners may now face the dual challenge of not only learning complex and challenging material but also doing so in a novel and effortful way. Use of the tool should be "well learned" and second nature before it becomes a required part of a course or program of study. And learners must be convinced that the tool helps them learn. In the latter regard, careful attention should be paid to feedback from students and instructors on success and failures stories, including the former as testimonials embedded in the tool.

Fourth, cognitive tools and learning strategies may work best when they are an integral feature of a course or program of study and not an add-on. This is the true meaning of *technology integration* or when the use of technology is not separate from the content to be learned but embedded in it. This integration may require the same degree of forethought, planning, and goal setting on the part of instructors to insure effective and efficient student use. And instructors need training and experience with the use of tools to encourage scalability and sustainability.

Summary

In this chapter, we argued for changes to primary quantitative/experimental research designs in DE/OL to examine alternative instructional treatments "head-to-head." We can see limited future improvements to DE/OL if comparisons to CI continue to prevail. How far would our understanding of automotive technology have progressed, for instance, if cars (i.e., "horseless carriages") were still designed as alternatives to horses? Secondly, we believe that DE/OL research and development is still in its infancy with regard to our ability to engineer successful interaction among students, between teachers and students, and between students and content.

The results of Bernard et al. (2009) confirmed the importance of student–student, student–content, and student–instructor interactions for student learning. The next generation of interactive distance education (IDE2) should be better designed to facilitate more purposeful interaction. Guided, focused, and purposeful interaction goes beyond whether opportunities for interaction exist to consider especially why and how interaction occurs. When students consider how they engage in learning they consider, or are provided with, the strategies and techniques for knowledge acquisition. We highlighted several evidence-based approaches useful in the next generation IDE2. These include principles and applications from the theories of self-regulation and multimedia learning, research-based motivational principles, and collaborative learning principles.

Self-Regulated Learning Principles

1. Include a forethought phase that involves task analysis (goal setting and strategic planning) and self-motivation beliefs (self-efficacy, outcome expectations, intrinsic interest/value, and goal orientation).
2. Provide a performance phase that includes self-control (self-instruction, imagery, attention focusing, and task strategies) and self-observation (self-recording and self-experimentation).
3. Integrate a self-reflection phase that includes self-judgment (self-evaluation and casual attribution) and self-reaction (self-satisfaction/affect and adaptive–defensive responses).

Multimedia Learning Principles

1. Reduce extraneous processing and the waste of cognitive capacity.
2. Manage essential processing and reducing complexity.
3. Foster generative processing and encourage the use of cognitive capacity.

Motivational Design Principles

1. Encourage adaptive self-efficacy and competence beliefs
2. Promote adaptive attributions and control beliefs
3. Stimulate higher levels of interest and intrinsic motivation
4. Insure higher levels of task value
5. Encourage the identification of goals that motivate and direct students
6. Participate in a context where knowledge is valued and used to motivate students

Collaborative and Cooperative Learning Principles

1. Structure positive interdependence such that one student's success positively influences the chances of other students' successes.
2. Highlight individual accountability in ways that each student is responsible for (1) his/her own learning and (2) helping the other group members learn.
3. Insure promotive interactions occur, allowing individuals to encourage and facilitate each other's efforts to accomplish the group's goals.
4. Maximize the likelihood that students give and receive elaborated explanations with a focus on encouraging understanding in others.

Overcoming Challenges to IDE2

1. Instructional designers should pay more attention to ease of use as an overall design objective.
2. Students need more guidance about when, under what circumstances, and for what purposes to use the tool.
3. Users need practice to use the tool well and wisely.
4. Cognitive tools and learning strategies may work best when they are an integral feature of a course.

Finally, in this chapter, we addressed several theoretical and empirical perspectives that should be explored more fully, but we have not specified in complete detail how instructional design and technology applications should converge to achieve a more interactive environment for teaching and learning at a distance. Achieving that goal is left to the creative and collaborative efforts of future researchers, designers, software engineers, and teachers.

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References

Abrami, P. C. (2010). On the nature of support in computer supported collaborative learning using gstudy. *Computers in Human Behavior, 26*(5), 835–839. doi:10.1016/j.chb.2009.04.007.

Abrami, P. C., Chambers, B., Poulsen, C., De Simone, C., d'Apollonia, S., & Howden, J. (1995). *Classroom connections: Understanding and using cooperative learning*. Toronto: Harcourt Brace.

Abrami, P. C., Wade, A., Pillay, V., Aslan, O., Bures, E., & Bentley, C. (2008). Encouraging self-regulated learning through electronic portfolios. *Canadian Journal on Learning and Technology, 34*(3), 93–117.

Allen, M., Bourhis, J., Mabry, E., Burrell, N., & Mattrey, E. (2002). Comparing student satisfaction with distance education to traditional classrooms in higher education: A meta-analysis. *American Journal of Distance Education, 16*(2), 83–97.

Anderson, T. (2003). Getting the mix right again: An updated and theoretical rationale for interaction. *International Review of Research in Open and Distance Learning, 4*(2), 9–14.

Bates, A. (1990). *Interactivity as a criterion for media selection in distance education.* In Paper presented at the annual conference of the Asian association of open universities, Jakarta, Indonesia, September 1990 (ERIC Document Reproduction Service No. ED329245).

Beldarrain, Y. (2006). Distance education trends: Integrating new technologies to foster student interaction and collaboration. *Distance Education, 27*(2), 139–153. doi:10.1080/01587910600789498.

Beldarrain, Y. (2008). Integrating interaction in distance learning: A comparative analysis of five design frameworks. In C. Bonk et al. (Eds.), *Proceedings of world conference on e-learning in corporate, government, healthcare and higher education 2008* (pp. 1471–1477). Chesapeake: AACE. Retrieved April 5, 2010, from http://www.editlib.org/p/29841.

Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, A., Tamim, R., Surkes, M. A., & Bethel, E. C. (2009). A meta-analysis of three interaction treatments in distance education. *Review of Educational Research, 79*(3), 1243–1289. doi:10.3102/0034654309333844v1.

Bernard, R. M., Abrami, P. C., Lou, Y., & Borokhovski, E. (2004a). A methodological morass? How we can improve the quality of quantitative research in distance education. *Distance Education, 25*(2), 175–198. doi:10.1080/0158791042000262094.

Bernard, R. M., Abrami, P. C., Lou, Y., Borokhovski, E., Wade, A., Wozney, L., et al. (2004b). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research, 3*(74), 379–439. doi:10.3102/00346543074003379.

Brookfield, S. (1995). *Developing critical thinkers*. San Francisco: Jossey-Bass.

Burns, T. C., & Ungerleider, C. S. (2003). Information and communication technologies in elementary and secondary education: State of the art review. *International Journal of Educational Policy, Research, and Practice, 3*(4), 27–54.

Cavanaugh, C., Gillan, K. J., Kromey, J., Hess, M., & Blomeyer, R. (2004). *The effects of distance education on K-12 student outcomes: A meta-analysis*. Naperville: Learning Point.

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin, 39*(7), 3–6.

Clark, R. E. (2000). Evaluating distance education: Strategies and cautions. *Quarterly Review of Distance Education, 1*(1), 3–16.

Cohen, E. G. (1994). *Designing groupwork: Strategies for the heterogeneous classroom*. New York: Teachers College Press.

Cook, D. A. (2009). The failure of e-learning research to inform educational practice and what we can do about it. *Medical Teacher, 31*(2), 158–162. doi:10.1080/01421590802691393.

Cook, D. A., Levinson, A. J., Garside, S., Dupras, D. M., Erwin, P. J., Montori, V. M. (2008). Internet-based learning in the health professions: A meta-analysis. *Journal of the American Medical Association, 300*(10), 1181–1196. doi:10.1001/jama.300.10.1181.

Daniel, J., & Marquis, C. (1979). Interaction and independence: Getting the mixture right. *Teaching at a Distance, 15*, 25–44.

Daniel, J., & Marquis, C. (1988). Interaction and independence: Getting the mix right. In D. Sewart, D. Keegan, & B. Holmberg (Eds.), *Distance education: International perspectives* (pp. 339–359). London: Routledge.

Fishman, B., Marx, R. W., Blumfield, P., Krajick, J., & Soloway, E. (2004). Creating a framework for research on systemic technology innovations. *Journal of the Learning Sciences, 13*, 43–76. doi:10.1207/s15327809jls1301_3.

Fulford, C. P., & Zhang, S. (1993). Perceptions of interaction: The critical predictor in distance education. *American Journal of Distance Education, 7*(3), 8–21. doi:10.1080/08923649309526830.

Garrison, D. R., & Shale, D. (1990). A new framework and perspective. In D. R. Garrison & D. Shale (Eds.), *Education at a distance: From issues to practice* (pp. 123–133). Malabar: Krieger.

Hickey, D., & McCaslin, M. (2001). A comparative, socio-cultural analysis of context and motivation. In S. Volet & S. Järvalä (Eds.), *Motivation in learning contexts: Theoretical advancements and methodological implications* (pp. 33–55). Elmsford: Pergamon.

Jahng, N., Krug, D., & Zhang, Z. (2007). Student achievement in online education compared to face-to-face education. *European Journal of Open, Distance and E-Learning.* Retrieved April 5, 2010, from http://www.eurodl.org/materials/contrib/2007/Jahng_Krug_Zhang.htm.

Jaspers, F. (1991). Interactivity or instruction? A reaction to Merrill. *Educational Technology, 31*(3), 21–24.

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher, 368*(5), 365–379. doi:10.3102/0013189X09339057.

Juler, P. (1990). Promoting interaction, maintaining independence: Swallowing the mixture. *Open Learning, 5*(2), 24–33. doi:10.1080/0268051900050205.

Knowles, M. S. (1980). *The modern practice of adult education: From pedagogy to andragogy*. Englewood Cliffs: Prentice Hall.

Latane, B., Williams, K., & Harkins, S. (1979). Many hands make light the work: The causes and consequences of social loafing. *Journal of Personality and Social Psychology, 37*(6), 823–832.

Laurillard, D. (1997). *Rethinking university teaching: A framework for the effective use of educational technology*. London: Routledge.

Lou, Y., Abrami, P. C., & d'Apollonia, S. (2001). Small group and individual learning with technology: A meta-analysis. *Review of Educational Research, 71*(3), 449–521. doi:10.3102/00346543071003449.

Lou, Y., Bernard, R. M., & Abrami, P. C. (2006). Media and pedagogy in undergraduate distance education: A theory-based meta-analysis of empirical literature. *Educational Technology Research and Development, 5*(2), 141–176. doi:10.1007/s11423-006-8252-x.

Machtmes, K., & Asher, J. W. (2000). A meta-analysis of the effectiveness of telecourses in distance education. *American Journal of Distance Education, 14*(1), 27–46. doi:10.1080/08923640009527043.

Mayer, R. E. (2001). *Multimedia learning*. New York: Cambridge University Press.

Mayer, R. E. (2008). *Learning and instruction* (2nd ed.). Upper Saddle River: Merrill Prentice-Hall.

McClelland, D. C., Atkinson, J. W., Clark, R. A., & Lowell, E. L. (1953). *The achievement motive*. New York: Appleton.

Meyer, E., Abrami, P. C., Wade, A., Aslan, O., & Deault, L. (2010). Improving literacy and metacognition with electronic portfolios: Teaching and learning with ePEARL. *Computers and Education, 55*(1), 84–91. doi:10.1016/j.compedu.2009.12.005.

Moore, M. G. (1989). Three types of interaction. *American Journal of Distance Education, 3*(2), 1–6.

Moos, D. C., & Azevedo, R. (2009). Learning with computer-based learning environments: A literature review of computer self-efficacy. *Review of Educational Research, 79*(2), 576–600. doi:10.3102/0034654308326083.

Muirhead, B. (2001a). Enhancing social interaction in computer-mediated distance education. *USDLA Journal, 15*(4). Retrieved April 5, 2010, from http://www.usdla.org/html/journal/APR01_Issue/article02.html.

Muirhead, B. (2001b). Interactivity research studies. *Educational Technology & Society, 4*(3). Retrieved April 5, 2010, from http://ifets.ieee.org/periodical/vol_3_2001/muirhead.html.

Nipper, S. (1989). Third generation distance learning and computer conferencing. In R. Mason & A. Kaye (Eds.), *Mindweave: Communication, computers and distance education* (pp. 63–73). Oxford: Pergamon Press.

Paivio, A. (1969). Mental imagery in associative learning and memory. *Psychological Review, 76*(3), 241–263. doi:10.1037/h0027272.

Paivio, A. (1971). *Imagery and verbal processes*. New York: Holt, Rinehart & Winston.

Paivio, A. (1986). *Mental representations: A dual coding approach*. Oxford: Oxford University Press.

Perry, N. E. (1998). Young children's self-regulated learning and contexts that support it. *Journal of Educational Psychology, 90*, 715–729.

Pintrich, P. R. (2003). A Motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology, 95*(4), 667–686.
Schmid, R. F., Bernard, R. M., Borokhovski, E., Tamim, R., Abrami, P. C., Wade A., et al. (2009). Technology's effect on achievement in higher education: A Stage I meta-analysis of classroom applications. *Journal of Computing in Higher Education, 21*, 95–109. doi:10.1007/s12528-009-9021-8
Seligman, M. E. P. (1975). *Helplessness: On depression, development and death*. San Francisco: W.H. Freeman.
Sims, R. (1999). Interactivity on stage: Strategies for learner-designer communication. *Australian Journal of Educational Technology, 15*(3), 257–272. Retrieved May 5, 2005, from http://www.ascilite.org.au/ajet/ajet15/sims.html.
Sitzmann, T., Kraiger, K., Stewart, D., & Wisher, R. (2006). The comparative effectiveness of web-based and classroom instruction: A meta-analysis. *Personnel Psychology, 59*(3), 623–664. doi:10.1111/j.1744-6570.2006.00049.x.
Steiner, I. D. (1972). *Group process and productivity*. Orlando: Academic.
Sutton, L. A. (2001). The principle of vicarious interaction in computer-mediated communications. *International Journal of Educational Telecommunications, 7*(3), 223–242. Retrieved April 5, 2010, from http://www.aace.org/dl/files/IJET/IJET73223.pdf.
U.S. Department of Education, Office of Planning, Evaluation and Policy Development. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Washington: USDE.
Wagner, E. D. (1994). In support of a functional definition of interaction. *The American Journal of Distance Education, 8*(2), 6–29. doi:10.1080/08923649409526852.
Webb, N. M. (1989). Peer interaction and learning in small groups. *International Journal of Educational Research, 13*, 21–40. doi:10.1016/0883-0355(89)90014-1 DOI:dx.doi.org.
Webb, N. M. (2008). Learning in small groups. In T. L. Good (Ed.), *21st Century education: A reference handbook* (pp. 203–211). Thousand Oaks: Sage.
Webb, N. M., & Mastergeorge, A. M. (2006). The development of students' helping behavior and learning in peer-directed small groups. *Cognition and Instruction, 21*(4), 361–428. doi:10.1207/s1532690xci2104_2.
Webb, N. M., & Palincsar, A. S. (1996). Group processes in the classroom. In D. Berliner & R. Calfee (Eds.), *Handbook of educational psychology* (pp. 841–873). New York: Macmillan.
Weiner, B. (1980). *Human motivation*. New York: Holt, Rinehart & Winston.
Wozney, L., Venkatesh, V., & Abrami, P. C. (2006). Implementing computer technologies: Teachers' perceptions and practices. *Journal of Technology and Teacher Education, 14*(1), 173–207.
Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts & P. R. Pintrich (Eds.), *Handbook of self-regulation* (pp. 13–39). New York: Academic.
Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments and future prospects. *American Educational Research Journal, 45*(1), 166–183. doi:10.3102/0002831207312909.
Zimmerman, B. J., & Tsikalas, K. E. (2005). Can computer-based learning environments (CBLEs) be used as self-regulatory tools to enhance learning? *Educational Psychologist, 40*(4), 267–271. doi:10.1207/s15326985ep4004_8.

The Design Critique as a Model for Distributed Learning

Brad Hokanson

Central to education in design is the *critique*. The critique methodology and practice is how design skills are developed around the world within a studio. It is there that work is presented by the designer, criticized by the learned and other learners, and its virtues and failures are debated.

The design critique may provide distance and online learning with a structured means for improving and intensifying the learning process. The critique system benefits both the learner, members of the class, and the critic. It begins with an idea, created from analysis, and an inventive process which is publicly described by the learner/designer. In itself, it is a challenge to the designer's abilities; information must be gathered and synthesized, and a guiding idea or concept, thesis, or *partí* must be developed and communicated to others. And, specifically, the designers must open themselves to the criticism of others and answer that criticism with the quality of their argument and improvement in their work.

The Nature of Design

It is valuable to briefly explore some ideas about the nature of design and to focus on the fields generally understood to be design, including architecture, graphic design, and industrial design. Other fields do consider aspects of their professions to be design, for example, mechanical engineering or computer science, but this chapter focuses on design as a profession and not as procedure or subset of a larger domain.

B. Hokanson, Ph.D (✉)
Department of Design, Housing, and Apparel, College of Design, University of Minnesota,
240 McNeal Hall, 1985 Buford Avenue, St. Paul, MN 55108, USA
e-mail: brad@umn.edu

L. Moller and J.B. Huett (eds.), *The Next Generation of Distance Education: Unconstrained Learning*, DOI 10.1007/978-1-4614-1785-9_5,

Contrary to the simple defining of design as "problem solving," it is, at skilled levels, problem *setting*. It is "… the process by which we define the decision to be made, the ends to be achieved, the means which may be chosen" (Schön 1983, p. 40). A central aspect of the design process, and consistent with most design fields, is a questioning of the design challenge itself; examining the assumption of the problem; and stretching the "problem space" (Cross 1997; Gero 2002). Central to the process of design is the questioning of the design problem. Here, the unique "vision" for the project is developed—the idea, the spark, the concept that drives all the work (Löwgren and Stolterman 2004).

Research in the process of design reveals observations that can be helpful to our understanding of design itself: quality comes not from following rules but rather through independent and seasoned expert judgment generally gained through designing (Cross 1997). Practicing expert designers generally do not follow a specific and rigid process (Cross 1997), and specifically, instructional designers do not consistently follow the ADDIE process (Visscher-Voerman and Gustafson 2004). Successful designers generally adapt their process to the context, and successful designers generally extend the project briefs and find their own way based on the project and context (Löwgren and Stolterman 2004; Cross 1997). Designers, when confronted with a simple problem to solve, often redefine or restate the problem, expanding the problem space and increasing problem complexity.

Design itself is a process of trying and evaluating multiple ideas. It may build from ideas, or develop concepts and philosophies along the way. In addition, designers, throughout the course of their work, revisit their values and design decisions. The work is a continuous, rapid, and repeated sequence of analysis, synthesis, and evaluation (McNeill et al. 1998). This same iterative process cycle has also been described as examining, drawing, and thinking (Akin and Lin 1995). Designers examine a problem, develop possible resolutions, and evaluate their own work as a regular part of their design process. This is a very internal and individual process, but one which benefits from engagement with others, particularly in the process of learning design.

"Expert" performance is not generally explicit or developed easily through didactic methods, but by tacit knowledge developed through years of active and guided performance (Dreyfus and Dreyfus 1986; Dorst 2008).

The Design Studio

One of the more recent developments in instructional design education has been the increasing use of design studios (Clinton and Rieber 2010). These studios have been instituted within a number of university programs for instructional design. They are based on the concept of project-based learning and modeled explicitly after pedagogical methods in other design fields such as architecture, interior design, and graphic design. "The originators of the studio curriculum … envisioned the learning of educational multimedia design to that of an art or architectural studio in which a group of people learn skills and develop expertise while working on authentic projects in a public space comprised of tools and work areas" (Clinton and Rieber 2010). Understanding their traditional function and methods will help direct the development and improvement of the use of studio in instructional design and, in other diverse fields, both in the classroom and via distance or online education.

Schön (1983, 1987) describes studio education as a "reflective practicum," a learning environment that encourages action, analysis, and reflection on one's own work. He describes the use of the reflective practicum in architectural education, master classes in music, and in the education of case workers in social work. The goal of each discipline is the development of "artistry" in each profession, i.e., a high level of tacit skill in the action is based on, but not limited to, extensive domain knowledge. In each field, the central efforts are not toward the development of content or factual knowledge (although design activity does encourage significant content learning), but toward the development of skills (such as designing, dancing, playing an instrument, or conducting an interview) and the integration of the learner into a community of professionals. "Artistry in the professions," per Schön, can be described as when the implicit skills are more dominant than the explicit rules consciously learned. In most cases in education today, explicit rules are dominant, tied to the research-based structure of "technical rationality" and the strictures of a test-based society (Schön 1983, 1985; Collins et al. 1989).

Studio-based education is learning through designing, a complex and rich form of experience. This complex form of instruction includes learning through applying analysis, synthesis, judgment, and arguing ideas. It generally deals with addressing and resolving issues in an exploratory manner: "The focus of a designer's training today still follows the Beaux-Arts tradition of open-ended projects and a variety of structured conversations that culminate in a public presentation of work" (Shaffer 2003, p. 5). It is one of the consistent aspects across design programs and schools worldwide.

Because design is a complex cognitive skill and is more than routine problem solving (Gero 1996), the goal of studio-based education is the development of higher order and often tacit thinking skills, including the development of the capacity for seeking and solving complex problems, being able to address multiple issues and context, and understanding and applying technological and social skills in varied and novel ways. Mere problem solving implies the direct application of protocol, the technical rationality of Schön (1983), instead of the mindful exploration of design (Löwgren and Stolterman 2004).

Aside from the structure and organization of the instructional activities of the course, studio-form education is different in that it involves very close working conditions for learners and instructors. The structure of a studio also varies in terms of *time* and *space* (Shaffer 2003) and in terms of pedagogical orientation. Learners work on a problem or problems structured to develop their design skills and intellect. Studios are typically organized around manageable projects of design, individually or collectively undertaken, and more or less closely patterned on projects drawn from actual practice. Exceptional freedom is given in the studio to define projects: "The designer chooses to address a particular issue. A solution is proposed. Strengths and weaknesses of the solution are analyzed (often in a public setting and usually in the form of feedback from others). Based on this analysis, the designer refines the original approach" (Shaffer 2003, p. 5).

There are comparable educational processes to design studios in other disciplines where knowledge is constructed through practice, and "artistry" is developed in a reflective practicum. These include the case study method, medical residencies, and master classes in the performing arts. It should be noted that the epistemologies of these examples are significantly different from most other fields and that there often remains a conflict between the "technical rationality" of much of the university and the applied practicum. Nevertheless, these forms of reflective practice remain the dominant forms of education in many disciplines.

One well-known comparable example is the case study system used in law and business. Complex problems are selected, ordered, and posed to learners to resolve. Through this effort, they learn the processes of their discipline that are used to address problems, and they develop the tacit skills of their profession (Schön 1983). Faculty in those fields use the selection of case studies to guide the learning; similarly, design educators use project selection, scale, and sequencing to guide student development.

These are also forms of learning which serve to inculcate the learner into professional standards of procedure and practice. Within a practicum, "The norms of the community become a framework for individual thinking and individual identity" (Shaffer 2003, p. 6).

Developing professional capability in design is a challenging arena, as the tacit knowledge of the designer is less declarative and more procedural: being able to design as opposed to being able to describe the design process, like leaning to ride a bicycle: "Design studios have evolved their own rituals, such as master demonstrations, design reviews, desk crits, and design juries, all attached to a core process of learning by doing" (Schön 1987, p. 43).

Instead of a classroom experience that includes lecture as a common means of distributing information, the studio concentrates on direct interaction between learner and instructor, and in some views, between student and master. "The professional knowledge of design, on the other hand, has been considered more or less tacit, which is reflected for instance in the traditional design school structures of master-apprentice learning and the importance of portfolios and exhibitions" (Löwgren and Stolterman 2004, p. 2).

Forms of Critique

Central to that interaction are the various forms of design critique, the active pedagogy of the studio. Design critique is a broad concept and has a variety of forms and descriptors. In general use, "critique" means a systematic and objective examination of an idea, phenomenon, or artifact. Within design, use of the term also includes that evaluation of an idea as well as the act itself.

In design, "critique" is often shortened to "crit," the more colloquially used term. Other terms with similar meanings include "review" and "jury." The term "critique" will be generally used here to refer to the broad range of activities involving presentation and criticism. The term "crit" will be used to describe individual or small group critiques; "desk crit," a central element in critique will be used to describe one-on-one sessions generally between learner and teacher, and student and critic. Final, formal, summative critiques are called "final reviews," "juries," or "final critique." Intermediate critiques will be noted specifically as interim.

There are a number of different forms of critique or crit. Blythman et al. (2007) describe a variety of different forms of critique which include, listed here by rough level of formality: peer crits, desk crits, online crits, formative crits, seminars, reviews or group crits, industry project crits, and summative crits. In this chapter, three of these distinctions are examined as structurally central to the use of critique in design and education: final critiques, desk crits, and peer crits (Table 1).

Perhaps the most well-known form of critique is the final review or jury. At surface, it sounds simple: "The review or jury is a formal group discussion of student work: individuals display their work, present their plans, and get feedback from professionals outside the studio" (Shaffer 2003, p. 5). In practice, a concluding and summative activity generally conducted in public is a complex forum with aspects of theater and performance.

Final juries were not always public. The juries of the Ecole des Beaux-Arts were held in private after collecting work from students. Grades and written comments were written directly on drawings. This process continued in most universities through the 1940s. Public presentations of design work became more common in the 1950s, and most design schools now hold final presentations in public, often with visiting professionals. "Students present their completed design work one by one in front of a group of faculty, visiting professionals, their classmates, and interested passersby. Faculty and critics publicly critique each project spontaneously, and students are asked to defend their work" (Anthony 1987, p. 3). While end of project critiques serve an evaluative role, as public events, they also are meant to be more of a didactic exercise for the full members of the course. The stated goal of many studio instructors is to have other students learn from comparison and criticism of the course projects.

It is small wonder, however, that the least successful aspect of studio and critique remains the final evaluative jury or review (Anthony 1987; Blythman et al. 2007; Percy 2004). Critiques are mainly a formative structure of interaction and evaluation on a personal basis. Summative critiques, ironically, take the most time and are probably the least effective at developing ideas and learning. In an environment meant to develop abductive and forward thinking, a concluding, evaluative event is necessarily less valuable (Martin 2007). "The final review was something of an exception in this sense, and it comes as no surprise that students, professors, and practicing architects feel overall that interim presentations are more useful learning experiences than final reviews" (see Anthony 1987; Shaffer 2003, p. 20).

Anthony (1987) focused her research on this traditional form of assessment and pedagogy which often slips into a didactic and non-educational form.

Table 1 Application of critique elements in academic practice and instructional design

Critique type	Brief definition	Mapped to traditional academic practices	Distance
Formal	Public, invited, summative, evaluative events	Structured and summative presentation formats: peer-reviewed journals, tenure and promotion judgments, dissertation oral defense	Scheduled and formalized digital video learner presentations using systems such as Adobe Connect
Seminar/group	Semipublic, less formal, more generative, but occasionally evaluative	Symposium format in which development of ideas or products is stressed as a group	Video, audio live with multiple participants; also recorded for podcast use
Desk	Conducted with mentor or instructor, highly generative, modeling of cognitive behavior potential for incidental learning	Modeling for graduate students, professional participation, individualized instruction	Voice over Internet protocol (VOIP) critique of remote learner; markup of papers or design work using remote control of computer desktops; screen capture with narration for remote use; archived for other student use
Peer	Highly informal, generative, voluntary or on request	Reviewing, exchanging, sharing research ideas with peers	Structured, scaffolded critique; informal sharing or practice of work

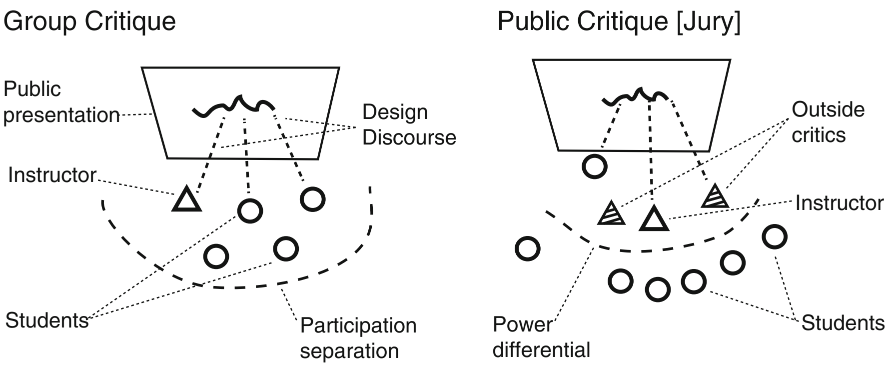

Fig. 1 Formative group critique and final critique/jury compared

Blythman et al. (2007) reported extensive survey data in which learner and staff participants found this form of critique to be poorly valued as an educational experience (Fig. 1).

Most forms of critiques (excepting final reviews) can themselves be either generative or summative; a broader range of forms exist for formative critiques, as noted in Blythman et al. (2007). Group-form critiques, intermediate pinups, and seminar form critiques are seen as very effective at engaging learners in a more generative and educational environment than within a final review. Blythman et al. (2007) found that students held seminar or group crits to be most successful. In this form, a small number of students present their work in an informally structured environment which still includes a studio tutor or critic. As a generative form, the process still focuses on the improvement and development of the design project. In studio, intermediate pinup reviews have much of the same coaching or generative functions.

While there often remains some connection with student assessment in all forms of critique, the generative forms can be detached from evaluation and be effective learning environments. And these generative forms can also serve a didactic purpose, engaging a broad range of students in the discussion and expression of design. The contrast with final reviews can be surprising and inconsistent with previous studio experience. "The tone of desk crits was almost always supportive and nonjudgmental. On the other hand, pinups and reviews, although constructive, were quite blunt and sometimes extremely critical—particularly in the case of formal reviews. Judgment was, in effect, off-loaded from the more private desk crits to the more public presentations" (Shaffer 2003, p. 2).

At its most positive, a generative critique is meant to "coach" or "guide" the learner to a more effective answer, develop judgment, and model tacit design/problem setting and solving skills. Per Schön, "The student cannot be *taught* what he needs to know, but he can be *coached*" (1987, p. 17).

Within academia, for example, summative critiques can be compared to the peer-review system in publishing, with final decisions occurring behind the closed doors of the blind review. The generative aspect of critique is comparable to a new process of the *British Journal of Educational Technology*, which has developed a mentoring system for publishing. A mentor may be assigned to the authors of a proposed piece, and open communication occurs in the review, development, and editing of an article (Cowan and Chiu 2009).

The Desk Crit

> He has to *see* on his own behalf … Nobody else can see for him, and he can't see just by being "told," although the right kind of telling may guide his seeing and thus help him see what he needs to see. (Dewey 1974, p. 151)

Central to the studio experience and the development of the ability of the student to learn to design in a thoughtful manner is the informal critique or desk crit (Schön 1983). A desk crit is "… an extended and loosely structured interaction between designer and critic (expert or peer) involving discussion of and collaborative work on a design in progress" (Shaffer 2003, p. 5). It is a small, informal conference between a student and a critic: professor, visiting professional, or another student. Varying in length, the desk crit is an intense personal engagement that reviews a student's design and thinking process. "This model of social interaction between student and instructor involves a critical conversation about the student's design, and usually involves both people working towards solving a problem" (Conanan et al. 1997, p. 2) (Fig. 2).

A crit may take place at any time in the sequence of a project, encouraged by the open nature of the studio environment, which encourages spur-of-the-moment interaction as well as scheduled discussions. In general, most of the activity during formal class time in a design studio will be consumed by individual students receiving criticism of their work from instructors or visitors. "During a crit, a student describes his or her work to the professor … . As students present possible solutions, the professor explores the implications of various design choices, suggesting alternative possibilities, or offering ways for the student to proceed in his or her exploration of the problem" (Shaffer 2000, pp. 251–252).

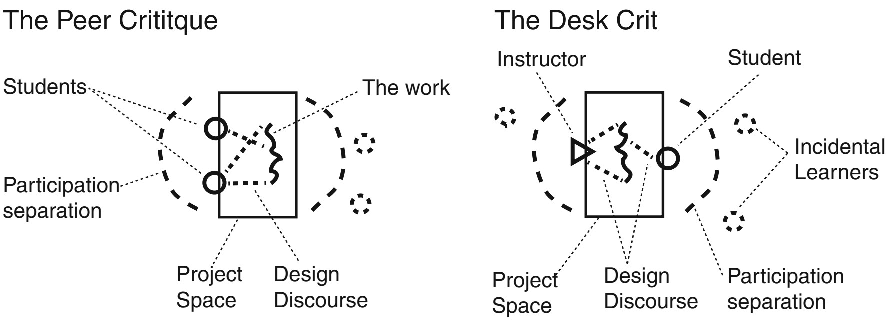

Fig. 2 On *left*, two students critique the work, both participating in the problem space. On *right*, an instructor gives a desk critique; adjacent students often listen to the critique process

Schön (1983, 1987) has done extensive observation of the desk crit and describes the detail of individual consultations between individual learner and studio instructor. This very focused tutorial session is critical to an effective studio environment. These are one-to-one learning sessions, and they deal with the development of the learner's skills in design. "In Schön's description, the desk crit functions as an instantiation of Vygotsky's (1978) *zone of proximal development*, with development taking place as learners progressively internalize processes they can first do only with the help of others" (Shaffer 2003, p. 5).

The individual working session of the single student can change their minds and their thinking process, providing, as Shaffer describes it, a social scaffolding of learning the design process. A main overreaching goal for design education is to instill an understanding and predilection for the critique, the generative evaluation of creative work. In terms of scale, the desk critique can be viewed as a lecture to one. However, the engagement, modeling, and attention to the work of the student remove this from the realm of lecture.

At the same time, there is a value to the other students in studio during a desk crit as well; procedures and ideas are observed as part of a repeated and iterative process. Additionally, while not as direct as a lecture, the informal observer/listener in a desk crit is always present, another student nearby, who is developing an understanding of the value of critique through incidental learning.

The importance of the informal crit in the development of learners in the studio is clear. Scaffolded with frequent engagement and the discussion of ideas, the student also develops an understanding of the value of this engagement, tacitly recognizing the value of engagement with other professionals and beginning to seek out criticism from their peers. They are trained in a future professional responsibility.

Peer crits are the least formal of the critique formats, but are the basis for an extended professional understanding of the use of critique. While they can provide an external review of one's design decisions, they also provide the critic with the opportunity to extend their own skill in critique and in the ability to review the validity and logic of a particular design idea or set of design choices. Any critique develops both the critic and designer.

Linking to Educational Theory

The studio/critique system can be mapped to various mainstream educational concepts. The design studio itself is comparable to problem-based learning, where complex challenges are posed to learners in various domains. Learning through solving authentic problems is valuable, both in terms of content and in the development of higher order thinking. However, with this as sole descriptor of the studio process, studio/critique system resets design as merely a process for developing domain knowledge through problem solution, and not as a means to intentionally develop problem-solving ability or, central to design, the defining of problems.

Shaffer (2003) describes the generative aspects of critique as a system of "social scaffolds," highlighting feedback from desk crits, pinups, and [intermediate] reviews (p. 25). Its value comes from the coaching and mentoring of design critics, professionals, and peers with the goal of improving design.

Perhaps, the closest similarity to mainstream educational theory is cognitive apprenticeship as outlined by Collins et al. (1989). Their presentation of cognitive apprenticeship can serve as a strong descriptor of the use of generative critiques in educational environments outside design. It could be hypothesized that the design studio model of critique as an educational process was a formalized process of traditional apprenticeship, which may have developed as architecture evolved from the crafts of masonry and building.

Collins et al. describe a dichotomy between current "schooling" practices and traditional use of apprenticeships in craft and various trades. They contend that one significant shortfall is that "…standard pedagogical practices render key aspects of expertise invisible to students. Too little attention is paid to the reasoning and strategies that experts employ when they acquire knowledge or put it to work to solve complex or real-life tasks" (Collins et al. 1989, p. 1). Schön also identified this modeling of cognitive processes as central to the value of the generative individual critique, a form of mentoring or coaching in the development of design thinking.

Collins et al. (1989) described methods in the use of cognitive apprenticeship and examined its use in teaching in three areas (reading, writing, and mathematics) which rest on "students' robust and efficient execution of a set of cognitive and metacognitive skills" (Collins et al. 1989, p. 4). Central to the use of cognitive apprenticeship (vs. traditional apprenticeship) were three precepts: identifying and making visible the processes of a given task, the use of authentic contexts, and varying situations to encourage transfer of previous learning. These parallel the research finding of both Schön (1983, 1987) and Shaffer (2003).

Much of the modeling of cognitive apprenticeship directly correlates to the individual critique, and to some extent, to multiperson generative group critiques and seminars. Peer critiques may have comparable cognitive value as well, as a significant component of some methods of cognitive apprenticeship.

Transition

Development of the skills of critique among faculty, adjuncts, visiting critics, and students may be one of the lynchpins of successful critique system. Currently, most design schools rely on the disciplines' own tradition of critique, and this may be a confidence that is ill placed. Integration of critique direction or instruction for peer critique is seen to have value by Collins et al. (1989) describing, through their online examples, a directed and grouped session that provides prompts, guidance, and scaffolding in the use of cognitive apprenticeship to learners.

Specific concerns regarding the application of critique within instructional design would include a lack of an explicit tradition of critique and nonstudio environments for coursework: Most courses in instructional design are conducted in a more didactic manner. Given the lack of a comparable experience in the use of critique within the field of instruction design and the development of distance education, there may be a strong call for training and development of faculty, as well as conscious education in critique-type systems for instructional design students.

Shaffer and Schön both note that the openness, space, and extended time of studio-form education contribute to the ability to engage in a variety of critique forms: peer, desk, and other informal critiques provide much of the value in a design education. "As McLuhan (1964) argued, 'the medium is the message,' and the organization of the Oxford Studio was part of the message to students that design is a process that evolves over time rather than a series of quick answers to short problems" (Shaffer 2003, p. 12).

Studios generally require low faculty-student ratios and a dedication of a more significant amount of time and dedicated space for studio-based courses. As administrators in design education well understand, studios are more resource intense than lecture courses, and as noted in Percy (2004), these qualities are under pressure.

Given current economic difficulties in the academy and the world, the economics of studio-form education may be difficult to maintain or introduce. Indeed, Percy (2004) noted that more and more design studios were being offered without a "base room" (a full-time dedicated studio space for each student), with much of the students' time on design projects being spent in isolation, separated from possible critique, and engagement with peers. Online critique may resolve some of the studio-oriented problems like extended time or space needs. As described by Conanan and Pinkard (2000), online critiques can provide a measure of the critique experience in developing design work. In their studies, prompts were used to provide guidance toward reflection on design and a discussion space for online input from peers or critics.

Apparently, even within an online critique, there are social structures and norms that should be established to frame and ensure the quality of the critique. Specific guidelines for evaluation of work are needed, for critics as well as for peer critiques by other students. Online critique may have other detriments; less value will be evident to students in the value of giving of critiques to peers, and less opportunity will exist for the informal, spur-of-the-moment critique. Incidental learning may be improved as all communication is solely through *intentional* postings read by a few. However, not all such materials will be read. One difficulty with text-mediated online critique is that while written comments are recorded for later use, they take significantly more time to review and process by the critic.

Similarly, the depth of a desk crit may develop from the extended time in the critique process, the openness of expended time in a studio environment allowing the informal interchange. In contrast, online time and involvement is all defined, conscious, metered, and, hence, limited. Media which most closely replicate the direct and unfiltered connection of the studio will be most useful; those such as synchronous video chats or shared desktops will provide the closest digital replication of an in-person design crit.

It is anticipated that educators and those in the field of instructional design will see more studio-based learning and pedagogy utilizing critique in the future. As the value of this form of complex learning is more fully recognized, broader use will be possible.

The value of critique in distributed learning and instructional design lies with the increased engagement encouraged within a studio environment, the building of structures for problem-based learning environments in other fields of education, the use within an instructional design product, and the development of rigorous, more media transparent venues for critique in online learning.

References

Anthony, K. (1987). Private reactions to public criticism: Students, faculty, and practicing architects state their views on design juries in architectural education. *Journal of Architectural Education, 40*(3), 2–11.

Akin O., & Lin, C. (1995). Design protocol data and novel design decisions. *Design Studies, 76*(2), 211–236.

Blythman, M., Orr, S., & Blair, B. (2007). Critiquing the crit. Retrieved March 19, 2010, from http://intranet.rave.ac.uk/quality/docs/LTR080107-Critprojectfinalsentreportversion2.doc.

Clinton, G., & Rieber, L. (2010). The studio experience at the University of Georgia: An example of constructionist learning for adults. *Educational Technology Research & Development*. Retrieved October 10, 2001, from http://www.springerlink.com/content/035116619636v888/fulltext.pdf.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the craft of reading, writing, and mathematics. In Resnick, L. B. (Ed.), *Knowing, learning, and instruction*: *Essays in honor of Robert Glaser* (pp. 453–494). Hillsdale, NJ: Lawrence Erlbaum Associates.

Conanan, D., & Pinkard, N. (2000). Studio zone: Computer support for reflective design. In B. Fishman & S. O'Connor-Divelbiss (Eds.), *Fourth international conference of the learning sciences* (pp. 176–177). Mahwah: Erlbaum.

Conanan, D. M., Pinkard, N. (1997). *Students' perception of giving and receiving design critiques in an online learning environment*. In Conference proceedings on computer supported collaborative learning, 22–24 March, Maastricht, Netherlands. Retrieved July 30, 2007, from http://www.unimaas.nl/euro-cscl/papers/29.pdf.

Cowan, J., & Chiu, Y. (2009). A critical friend from BJET? *British Journal of Educational Technology, 40*(1), 59–60.

Cross, N. (1997). Descriptive models of creative design: Application to an example. *Design Studies, 18*(4), 427–440.

Dewey, J. (1974). *John Dewey on Education: Selected Writings*. (R. D. Archambault, ed.) Chicago: University of Chicago Press.

Dorst, K. (2008). Viewpoint: Design research: A revolution-waiting-to-happen. *Design Studies, 29*(1), 4–11.

Dreyfus, H. L., & Dreyfus, S. E. (1986). *Mind over machine: The power of human intuition and expertise in the era of the computer*. New York: The Free Press.

Gero, J. S. (1996). Creativity, emergence and evolution in design: Concepts and framework. *Knowledge-Based Systems, 9*(7), 435–448.

Gero, J. S. (2002). Computational models of creative designing based on situated cognition. In T. Hewett & T. Kavanagh (Eds.), *Creativity and cognition 2002* (pp. 3–10). New York: ACM.

Löwgren, J., & Stolterman, E. (2004). *Thoughtful interaction design: A design perspective on information technology*. Cambridge: MIT Press.

Martin, R. (2007). *The opposable mind*. Boston: Harvard Business School Press.
McLuhan, M. (1964). *Understanding media: The extensions of man*. New York: Mentor Books.
Neill, T. M., Gero, J., & Warren, J. (1998). Understanding conceptual electronic design using protocol analysis. *Research in Engineering Design, 70*(3),129–140.
Percy, C. (2004). Critical absence versus critical engagement: problematics of the crit in design learning and teaching. *Art, Design & Communication in Higher Education Journal, 2*(3), 143–154.
Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. Burlington: Ashgrove.
Schön, D. (1985). *The design studio: An exploration of its traditions and potentials*. London: RIBA.
Schön, D. (1987). *Educating the reflective practitioner*. San Francisco: Jossey-Bass.
Shaffer, D. W. (2000). Design, collaboration, and computation: The design studio as a model for computer-supported collaboration in mathematics. In *CSCL '97 proceedings* (pp. 249–255). Toronto: Ontario Institute for Studies in Education.
Shaffer, D. W. (2003). *Portrait of the Oxford studio: An ethnography of design pedagogy*. Madison: Wisconsin Center for Education Research. Retrieved 24 April, 2010, from http://www.wcer.wisc.edu.
Visscher-Voerman, I., & Gustafson, K. (2004). Paradigms in the theory and practice of educational and training design. *Educational Technology Research and Development, 52*(2), 69–89.
Vygotsky, L. S. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.

The Effect of Delivery Method of Instructional Materials to Meet Learning Goals and Objectives in Online and Open Learning Environments

Jonathan O. McKeown and Sarah K. Howard

Introduction

Technology continues to change rapidly and grow exponentially year after year especially in the area of communication technology. One of the significant changes is the affordance of communication and distribution networks supporting these technologies. Thus, with Internet access becoming ubiquitous for a large part of our population, we live in a time where information is available anytime, anywhere, and from a multitude of devices. There is potential for unprecedented access, through these networks, to deliver knowledge and materials to learners through increasingly portable and mobile devices. Increased access and portability create a number of predictable and unpredictable ways learners can engage with knowledge and course materials. New possibilities for content delivery present a number of unique implications for learning, thus presenting a number of considerations for learning and course designers.

In the traditional classroom setting, learners engage with content aurally (e.g., in the form of a teacher-directed lecture or class discussion). In online environments, learners would be exposed to both visual and aural instruction within a type of device or learning platform (e.g., reading an article, watching a video). Typically, the format of learning is dictated by the tool being used to create or deliver the instruction, with little consideration to how or where the learner will consume the material. Therefore, if we intend to develop and deliver instruction so that learners are constructing knowledge and developing a deep understanding of problems, we need to focus less on the endless changing functionality of electronic devices and

J.O. McKeown, Ph.D (✉)
University of Tampa, Box: S, 401 W. Kennedy Blvd., Tampa, FL 33606, USA
e-mail: jmckeown@ut.edu

S.K. Howard, Ph.D
Faculty of Education, University of Wollongong, Wollongong 2522, NSW, Australia
e-mail: sahoward@uow.edu.au

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more on the impact of delivery formats (e.g., audio, text, etc.) available to engage learners. Moreover, while content may be delivered in a variety of formats, we do not know where and how learners will be using this content. This chapter theorizes that an important consideration for instructional designers and educators is how to best develop and deliver instructional materials to learners while keeping in mind that learners may engage with content in a variety of unpredictable ways. These ideas were examined through a small study investigating the effectiveness of audio- or text-based content materials in an online course. Learners using audio-only resources showed higher achievement on the final assessments than students using text-only or a combination of the two. While this is potentially an important finding in itself, there is the additional consideration of *how* and *where* they used the audio resources. These findings suggest implication for the consistency of learning and modality principles in these informal settings.

The Format of Instruction Delivery

Prior to the current accelerating trend in communication-based technology, there were differing opinions on media's influence on learning outcomes. On one side, there was a claim that medium has no effect on learning outcomes (Clark 1994; Martin and Rainey 1993; McClure 1996). Several viewed media and instructional methods as two separate entities in which media has no value. This is in contrast to the argument that media and instructional methods cannot be separated from each other and that media does have an effect on learning outcomes (Kozma 1991; Reiser 1994). Jonassen (1994, 2004) presented a slightly different view, that the debate should be framed by focusing on learner-centered learning rather than media- and instruction-centered learning. A recent look by McLaughlin et al. (2007) noted in a meta-analysis of literature comparing instructional effectiveness with presentation media that the results of multiple studies conflicted with each other and offered little if any conclusive results about the effectiveness of media formats. At this point in time, we are aware of some differences in learning related to media (e.g., text or aural), but it is not clear if the principles change when the learner adapts the media to their own specific uses in their own unpredictable spaces and time.

While some research has argued that the medium does not have an impact on learning, research in cognitive load theory has proven differently. Cognitive load theory has shown that some formats of delivery are more effective than others. We will specifically address Kalyuga et al.'s (1999) earlier work examining the initial effectiveness of aural and text delivery. Their work has shown that the use of audio text in learning scenarios commands less cognitive load and shows higher student results on assessments—the *modality principle*. While this holds true for some types of learning, it has been shown that complex and unfamiliar visual diagrams are more effective when presented visually, rather than in an aural format (Mayer 2005). These findings have significant implication for the design of online distance education models, but of greater interest is how these properties are considered in relation to informal and portable learning environments. Looking again at Mayer's (2005) work, we see that the nature of the task impacts on the effectiveness of the medium. It could be possible that the nature of location and multitasking changes the quality of learning. Therefore, in the age of flexible and portable learning, we need to determine if principles of modality hold true if a learner is washing the car while listening to a lecture.

Methods of Instruction Delivery

The majority of online distance learning is delivered through web-based learning management systems (LMSs). Most of the major LMSs provide instructors with the ability to move online course content beyond text-only delivery to include audio, video, or combinations of different types of instructional media. There are a variety of ways these tools can be combined, but in many cases, only the text functions such as course readings, discussion boards, and text-based lectures seem to be used (Fung 2005; Passerini 2007). In a typical online course, a teacher will post articles, create text-based instructional material, and upload PowerPoint files which the student is then expected to read and study. The student has the ability to read the material on the computer, print it out, transfer it to a portable device, or use multiple methods of consuming the instruction that could involve different strategies for reading and studying. This text-focused treatment of online content does not take advantage of the affordances offered by new devices and communication technology. Audio on the other hand may be more consistent to what a student experiences in a traditional classroom setting. This could be in the form of an audio lecture from a face-to-face class posted online, an audio interview, or may be audio material created exclusively for the class such as a podcast. The student has a few more options on how to access and study the audio material. A student could listen to it while at the computer, copy it to a portable device, such as a phone or MP3 player, or burn it to a CD. The audio currently provides portability and flexibility at a level not available to the print-based material and lends itself to be reviewed and listened to while performing other tasks such as driving or performing other activities.

Focusing on text-based delivery is not an unreasonable choice on the part of the instructor as there are numerous studies identifying the technical challenges of the medium (Brown 2007; Flanagan and Calandra 2005). Conversely, other research describes the positive motivational effects of using audio materials in online courses (Copley 2007). While both positions are valid, new technologies *are* changing how instruction can be delivered and received, but the relative learning gains are relatively untested.

Exploring the Issues in Context

In an attempt to address some of these issues, we will illustrate and explore some of these questions through a small focused exploratory study. The study was conducted to determine if the delivery format of instructional material has an effect on learners' retention of declarative knowledge and application of conceptual knowledge in an online course environment. One of the benefits of this study was the ability to also examine how and where students were using text or audio course materials. The study focuses on text (visual format) or audio (aural) delivery to determine if audio, text, or a combination of both provides better retention of knowledge and application of concepts based on the format of instructional material.

We hypothesized that the learners who were exposed to the audio narration would score higher on both posttests (knowledge retention and concept application) as compared to the other two groups. These hypotheses were based on the assumption that the accessibility and attractiveness of the audio materials would have a positive impact on the learners' motivation to study the materials, following the recent trends of consumer electronics and communication technologies. It was expected that students receiving the instructional materials by audio would perform better than those receiving the material by print on both the declarative and conceptual knowledge application. This is based first on students being more familiar with receiving instruction aurally as is done in the traditional face-to-face classroom setting. Further, students receiving the material by audio also have more methods and opportunities to listen and study the material based on current devices used to consume instructional material. For example, they could listen while they drive, clean their room, or simply listen and be able to write notes on things they find important. When the instruction is delivered by text only, students can read it on the computer or print it out as the primary options for learning the material. While more portable electronic readers are currently entering the market, these still have reached a limited saturation point with typical learners. With an audio version, students can listen on the computer, load it on their cell phones or MP3 players, or burn it to a CD to listen to, displaced from the typical LMS window presented by the computer. The instruction becomes highly portable and can be carried with them on devices they use every day.

It was also expected that students who received both the text and the audio would perform better than the other two groups on the posttest assessments. Students in this group would have a choice in how they could study and access the material whether they decide to listen, read, or both. Daft and Lengel (1986) also provide theoretical support to this hypothesis in their media richness theory that multiple channels will provide an increased chance of effective learning. As we will note later, this proved to be incorrect as students simply chose to ignore the additional options provided to them and defaulted to simply using the text material.

Details of the Illustrating Study

The participants in the exploratory study were 67 high school students located in Florida taking an online elective course that focused on developing leadership skills. All students in the course were voluntarily enrolled; the course was not required for any reason. The purpose of the course was to teach students how to lead through the application of leadership principles when they are not part of the top leadership of an organization. All students participating in this study received the same unit of instruction drawn from a popular leadership textbook.

The participating students were selected from a larger population of 128 students enrolled the course. The participants were identified for the study midway through the course based on their active participation and that they had not fallen more than 2 weeks behind in their coursework. The students were all currently enrolled in high school in the United States and between the ages of 14 and 18. The race of the students was predominantly white (85%) with 35 female participants and 32 male participants.

The unit of instruction, identified for the study, covered a 4-week time period to allow students to adequately participate in the experiment. This was consistent with the amount of time given to other instructional units not part of this experiment. The instruction included nine chapters in the leadership textbook. With each chapter section, a description of several principles, examples of each principle, and how to apply the principles were presented. Instruction included clear definitions of the concepts, placing the definition into the context of an example, and how the author applied the concepts to real-world examples. Each chapter of instruction followed the same systematic, objectivist, way of presenting the material with the definitions first, followed by examples, and then the application of these principles to organizations. The instruction from the book was then developed into two formats, one text based and one audio based. The materials in both formats were the same with exception that one was designed to be presented in a readable format, while the other was designed to be delivered aurally.

Participants were randomly assigned to one of three groups. Each group received the content in a different combination of formats: (1) audio delivery only ($n=23$), (2) text delivery only ($n=22$), and (3) combination of audio and text delivery ($n=22$). For Group 1, the audio material was a verbatim reading of the text; therefore, it was the same as the text, only in an aural format. Each textbook chapter was one audio file. For Group 2, the printed text was divided into nine text-based PDF-formatted files. As with the audio, each text file included one chapter from the textbook. Group 3 had access to both the audio files and text files. Audio and text files were grouped together by chapter rather than by format. Students had the choice of which format they preferred or could use both if they chose to do so. The same directions were given to each group, with modifications for the format such as read, listen, or listen and read depending on the groups' instructional materials format. Learners were further instructed that once they felt comfortable with the material, they were able to take the assessments at the end of the unit.

During the course of the experiment, reminder e-mails were sent to each participating student. One scheduled reminder e-mail was sent after 1 week to encourage students that had agreed to participate to work on the unit and take the assessment. All three of the groups were given an equal amount of time to review the material in the course. The assessments were designed as closed book assessments that only allowed each student one attempt and then the students were locked out of the assessment. Included in the assessment was a survey asking about demographics, study habits, methods participants used to study, as well as what they were doing as they studied.

Learners were assessed on their retention of declarative knowledge and their level of conceptual knowledge (deep understanding). Retention of declarative knowledge was assessed using an online multiple choice test. The questions were drawn directly from the material without modification of the wording or structure of the content. This test was developed by the author as supplemental material included with the instructor's version of the textbook. The test was designed to measure the amount of retention of terminology, facts, and figures that required lower level recall skills. Application of concept knowledge was measured through students' use of concepts to a context-specific scenario. Each question focused on a specific problem or process of leadership in an organization. Students had to solve a complex problem in the given scenario using the concepts learned. One of the primary scenarios given was how the student could influence change when the responsibility for implementing change was explicitly given to another leader higher in the organization. Assessments were double-blind marked using a rubric created to evaluate if solutions demonstrated a successful application of the concepts to solve the problem. Both the declarative knowledge questions and the conceptual knowledge questions were marked as either acceptable (pass) or unacceptable (fail).

At the conclusion of the instructional unit, the material used for each group was posted into the main course site to enable participants from each group to have access to all formats of the material. This was done to provide the material not only to the participants but also to all students in the course.

Retention of Declarative Knowledge

Table 1 shows the means and standard deviations of each of the three groups on the declarative knowledge–based questions. One-way analysis of variance was conducted on the declarative knowledge test data with the treatment serving as the between-subjects factor. The groups showed a significant difference on the declarative knowledge–based questions, $F(2,27)=11.53$, $\text{MSE}=48.90$, $p<0.001$, indicating that the treatment did differ significantly between the groups on recalling

Table 1 Declarative knowledge retention and conceptual knowledge application posttest mean scores and standard deviations by treatment group

	Posttest	
Group	Declarative knowledge	Concept application
Audio only	78	79
$n=23$	(2.0)	(3.2)
Text only	45	38
$n=22$	(2.1)	(2.9)
Audio and text	36	48
$n=22$	(2.0)	(3.3)

Note: Numbers in parentheses are standard deviations
Maximum score per cell = 100

information from the instructional material. A Tukey's test, with alpha at 0.05, showed that the audio-only group performed better than the text-only group ($p = 0.004$) and the audio and text group ($p = 0.001$). The text-only and text and audio groups did not differ significantly from each other ($p = 0.60$). The effect size using Cohen's d to compare the groups was 0.56 which is considered to be a medium effect size (Cohen 1988).

Application of Conceptual Knowledge

Conceptual knowledge application was measured by having students respond to questions based on applying concepts to a context-specific scenario. These responses were evaluated by two independent examiners to determine whether the answer adequately applied knowledge from the instructional material and appropriately address the problem scenario. Table 1 shows the means and standard deviations of each of the three groups on the conceptual knowledge assessment. One-way analysis of variance was conducted on the conceptual knowledge test data with the treatment serving as the between-subjects factor. The groups showed a significant difference, $F(2,27) = 5.03$, $MSE = 10.83$, $p = 0.01$, indicating that the treatment did differ significantly in applying concepts from the instructional material to scenario-based problems. A Tukey's test, with alpha at 0.05 showed that the audio-only group performed better than the text-only group ($p = 0.014$) and the audio and text group ($p = 0.015$). The means of the text-only and text and audio groups did not differ significantly from each other ($p = 0.73$). The effect size using Cohen's d to compare the groups was 0.46 which is considered to be a medium effect size (Cohen 1988).

Self-Reported Survey Results

At the end of the questionnaire, participating students were asked to report the following: (1) "How did they use and/or study the material" and (2) "What did students do while reading and studying?" Table 2 reports the results of these two items. Students were also asked: "What other tasks they were performing while reading and studying? (matched to earlier responses)." This was an open-ended response question.

In Group 1 (text only, $n = 23$), of the 82% reading and studying the material online, over half of the students indicated that they were only focused on the material while studying (12). Other responses from students in Group 1 that "read the material online" or "a mixture of online and offline" were:

- Instant messaging
- Social networking
- Web browsing

Table 2 Students' use of audio and text materials

	Read online	Listened online	Read offline[a]	Listened offline[b]	Read offline and online	Listened offline and online
1 (Text only)	82% (18)		5% (1)		5% (3)	
2 (Audio only)		23% (5)		78% (18)		0% (0)
3 (Audio and text)[c]	74% (17)	9% (2)[d]	0.05% (1)		0.05% (1)	

[a]Printed and read offline
[b]Downloaded to device (e.g., phone, MP3 player)
[c]21 Participants, one no response
[d]The two students listened while reading along with the text

The student that only read the material offline indicated that they only focused on the material, highlighting the important points and ideas, and making notes out to the side. Four students did not respond to this item and one responded "cannot remember."

The students in Group 2 (audio only, $n=22$) listening to the audio on the computer (23%, (5)) reported similar activities to Group 1 students who read the material online. These activities included:

- Social networking
- Web browsing
- Looking at pictures

One student indicated that they "only listened to the audio" and another indicated that they were "listening to the audio and reading the material from the previous unit." The 18 students (78%) who downloaded the audio and listened to it offline indicated participating in wide variety of activities while listening to the recordings. These activities included:

- Mowing the lawn
- Doing housework
- Cleaning their room
- Lying in bed before sleeping
- Driving
- Working on other homework
- While on breaks at school
- Doing something on the computer while listening
- "Other things" and "other stuff"

Five students, in the group, indicated that they took notes and wrote down important parts while listening to the recordings, or they "in some way" performed a task to reinforce what they were hearing, such as writing down material. The students in Group 3 ($n=22$), receiving both audio and text, indicated many of the same habits while using the resources.

Discussion of Instructional Format and Delivery Method

This illustrative study was designed to explore difference in how the format of instructional materials affects student learning. The primary purpose of this study was to determine if the format of instructional materials and delivery method had a significant effect on declarative knowledge retention and application of conceptual knowledge of students in an online distance learning course. Further, this chapter theorizes that an important consideration for instructional designers and educators is how to best develop and deliver instructional materials to learners while keeping in mind that learners may engage with content in a variety of unpredictable ways. Further, the discussion considers how and where learners are engaging with content and if this impacts on quality of the learning.

First, it was hypothesized that students who received both text and audio instruction would perform better on both declarative and conceptual knowledge application than the groups receiving the instruction in only one medium; this was not supported. Findings show that students engaged with course materials in a variety of ways, but these ways were fairly consistent within groups. For example, in Group 1, the students tended to read the course materials online (82%) rather than print the resources. This is interesting as reading on the computer is a fairly fixed activity rather than portable. The students in group 2 were most likely to download course materials (78%) and listen to them on other devices while performing other activities. Interestingly, when participants were given the option, they were likely to read materials online rather than download for listening on devices. Students' preferences were not consistent with achievement on assessments. Groups 1 and 3 preferred the text materials to audio, but findings have shown that Group 2, which was the audio-only instruction, was more successful on both the declarative and concept application assessments.

It was originally suspected that students who had the choice between text, audio, or both would perform significantly better based on receiving the instruction on multiple channels (Daft and Lengel 1986). One reason that this group did not perform better than the other two groups may be due to these students not taking advantage of the multiple channels and only choosing one type of medium rather than both. Instead of receiving the instruction by both text and audio, the students tended to only chose one type of channel and used that consistently throughout the instruction. There is also the possibility that with links to both audio and text files, the instructional materials were overwhelming to the students, given the time frame in which to complete the materials and take the assessment. This may have led to only learning the material at a surface level rather than working with the material in depth.

Students receiving the audio instruction had more portability with the instructional material than the group receiving the instruction by text. Group 2 results showed that they indeed took advantage of the portability of the format. They tended to perform other tasks while listening to the audio. Students in this group indicated that they listened to the material while driving, doing chores, or performing other tasks. Many of these types of activities would not be possible with the text-based material even once it had been printed onto paper. Performing other tasks did not seem to impact upon their retention of declarative knowledge or their resulting ability to apply conceptual knowledge. It is important to note that most students were doing active and low cognitively engaging tasks. Interestingly, while over half of Group 1 (text only) focused on reading the course material, participants in Group 2 performed a variety of tasks while listening to the audio and performed better on the assessments.

Further Discussion

The results of the present study stand in contrast to the findings of previous studies, and they seem to reopen a debate that started 25 years ago with Clark (1994). However, the present results should be viewed with some caution. Limitations of sample size and subsequent lack of reliable survey data needed to qualify and correctly interpret the findings point to the need to replicate the study in a larger, more diverse context. Additionally, it may be valuable to vary the content and format of the materials in order to measure whether format-specific enhancements—such as the use of italics in text or sound effects in audio materials—have an effect on learning outcomes. Finally, measures of learner motivation should be included in future studies. Given that younger generations are used to media-rich entertainment, the question whether audio is more effective than text may be less relevant than the question which combination of media is more effective for a given learning goal. If learners are not motivated to use the materials because they perceive them as antiquated or boring, the materials have a smaller chance of being effective for these learners.

Based on this study and a review of current literature, we suggest that instructors who teach online or deliver instruction at a distance should consider incorporating audio into their instructional materials. We base this on the noted portability of the instruction and the ability to perform a myriad of other tasks while receiving the instruction. As we write this, however, we make note that the ability to access visual materials in a more portable form is increasing, thanks to advances in electronic communication devices. What we do not anticipate changing is the ability to perform multiple automated tasks while reading as opposed to listening. When we think of activities like cleaning, driving a car, or sorting, many of these tasks are automated and require minimal cognitive load. Being engaged visually, however, requires more focus and an inability to effectively perform other tasks, at least in an automated fashion.

As devices that allow the transport of audio material become more pervasive, instructors should think about adapting instruction to take advantage of portability. We do not make the claim that text material should be abandoned in an online environment, just that instructors should consider multiple delivery methods. While considering the noted limitations to our small focused study, the findings do suggests that the format of instructional materials may play an important role in student learning and should be taken into account by all teachers who teach in an online environment.

We are perhaps starting to see signs of a paradigm shift in the way electronic devices can be used to create and more importantly, receive instruction. We might even begin to see the format we use to create the instruction become irrelevant as devices are capable of converting those materials on demand into a format more suitable for the individual learner. This could give learners further control over how they decide to use and consume instruction. This said, it is suggested that learning designers and instructors focus less on devices and technology and instead focus more on the delivery of quality instruction that is the most effective for the given learning environment whether it is face-to-face, web-based, or in a virtual environment. To do this, we must consider how the devices, platforms, and communication technology shape how students access instruction, as well as the myriad of possibilities for using the instructional material. Most importantly, we need to understand what provides for effective learning gains that are able to extend to support the application of knowledge and the development of complex problem-solving skills. Ultimately, we argue that the future of education will be less driven by new technological devices and will continue to rely heavily on and require a high level of instructional design based on the situation, domain, and content. Learners may have more control over the consumption of content, but well-crafted instruction should be capable of being formatted and manipulated by the learners to adapt to changing devices and communication methods. The biggest change for designers and educators is to adapt to this change by recognizing that the desired intent of how instruction will be used may differ from how learners ultimately view, listen, and consume the instruction.

References

Brown, A. & Green, T. D. (2007). Video podcasting in perspective: The history, technology, aesthetics, and instructional uses of a new medium. *Journal of Educational Technology Systems*, v36 n1, pp. 3–17.

Clark, R. E. (1994). Media will never influence learning. *Educational Technology, Research and Development, 42*(2), 21–29.

Copley, J. (2007). Audio and video podcasts of lectures for campus-based students: production and evaluation of student use. *Innovations in Education and Teaching International*, v44 n4, pp. 387–399.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale: Lawrence Erlbaum.

Daft, R. L., & Lengel, R. H. (1986). Organizational information requirements, media richness, and structural design. *Management Science, 32*, 554–571.

Flanagan, B. & Calandra, B. (2005). Podcasting in the classroom. *Learning & Leading with Technology*, 33.3, p. *20*(4).

Fung, Y. Y. H. (2005). Teachers' views on and use of printed materials in a distance learning teacher education course. *Open Learning, 20*(2), 175–183.

Jonassen, D. H. (2004). *Handbook of research on educational communications and technology*. Mahwah: Lawrence Erlbaum.

Jonassen, D. H., Campbell, J., & Davidson, M. (1994). Learning with media; restructuring the debate. *Educational Technology, Research and Development, 42*(2), 31–39.

Kalyuga, S., Chandler, P., & Sweller, J. (1999). Managing split-attention and redundancy in multimedia instruction. *Applied Cognitive Psychology, 13*(4), 351–371.

Kozma, R. B. (1991). Learning with media. *Review of Educational Research, 61*(2), 179–211.

Martin, E. D., & Rainey, L. (1993). Achievement and attitude in a satellite-delivered high school science course. *The American Journal of Distance Education, 7*(1), 54–61.

Mayer, R. E. (Ed.). (2005). *The Cambridge handbook of multimedia learning*. New York: The Cambridge University Press.

McClure, P. A. (1996). Technology plans and measurable outcomes. *Educome Review, 31*(3), 29–30.

McLaughlin, A. C., Rogers, W. A., Sierra, J. E. A., & Fisk, A. D. (2007). The effects of instructional media: Identifying the task demand/media match. *Learning, Media, and Technology, 32*, 381–405.

Passerini, K. (2007). Performance and behavioral outcomes in technology-supported learning: The role of interactive multimedia. *Journal of Educational Multimedia and Hypermedia, 16*(2), 183–211.

Reiser, R. A. (1994). Clark's invitation to dance: An instructional designer's response. *Educational Technology, Research and Development, 42*(2), 45–48.

Using the Community of Inquiry Framework to Inform Effective Instructional Design

Jennifer C. Richardson, J. Ben Arbaugh, Martha Cleveland-Innes, Philip Ice, Karen P. Swan, and D. Randy Garrison

Introduction

In the United States, 4.6 million students took at least one online course during fall 2008, a 17% increase from the previous year. US schools offering these courses have seen increases in demand for e-learning options, with 66% and 73% of responding schools reporting increased demand for new and existing online course offerings, respectively (Allen and Seaman 2010). Indeed, online learning, at least at the higher education level, has advanced from an interesting experiment to "the new normal" (Davidson and Goldberg 2009) in a relatively short amount of time. Moreover, indications are that online learning is more engaging than face-to-face learning and that students learn more online as a result. The National Survey of Student Engagement (NSSE 2009), which in 2008 tested technology questions with 31,000 students at 58 institutions, for example, found significant positive correlations between the use of course management systems and high-tech communications in college courses and

J.C. Richardson, Ph.D (✉)
College of Education, Purdue University, West Lafayette, IN, USA
e-mail: jennrich@purdue.edu

J.B. Arbaugh, Ph.D
College of Business, University of Wisconsin-Oshkosh, Oshkosh, WI, USA

M. Cleveland-Innes, Ph.D
Centre for Distance Education, Athabasca University, Athabasca, AB, Canada

P. Ice, Ed.D
American Public University System, Charles Town, WV, USA

K.P. Swan, Ph.D
Center for Online Learning, Research and Teaching, University of Illinois Springfield, Springfield, IL, USA

D.R. Garrison, Ed.D
University of Calgary, Calgary, AB, Canada

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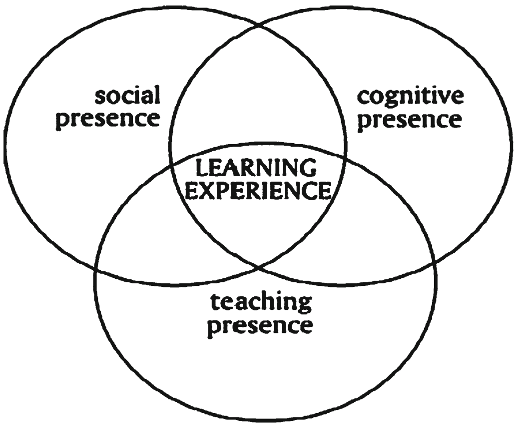

Fig. 1 Community of Inquiry (CoI) framework

all the NSSE engagement indicators. In addition, a recent meta-analysis of empirical studies comparing online and face-to-face learning commissioned by the US Department of Education (Means et al. 2009) revealed that students who took part or all of their classes online outperformed colleagues who took solely face-to-face classes. The authors of this study report that their findings hold across variations in students, institutions, implementations, and disciplines.

Clearly, online learning deserves more serious and more rigorous study. While researchers have been relatively successful in identifying the properties of successful online learning environments (Aragon 2003; Cleveland-Innes, Garrison & Kinsel 2007), a more in-depth analysis requires a theoretical framework that illuminates the complexities of online learning. One model that has gained a good deal of attention is the Community of Inquiry (CoI) framework developed by Garrison et al. (2000). The CoI framework is a collaborative constructivist model of online learning processes that can inform both research and practice. It assumes that effective online learning requires the development of a learning community (Rovai 2002; Shea 2006; Thompson and MacDonald 2005) which supports the meaningful inquiry and deep learning that is the hallmark of higher education (Dewey 1938).

The CoI framework views the online learning experience as a function of the relationship between three elements: social presence, teaching presence, and cognitive presence (see Fig. 1). The term "presence" was deliberately chosen to distinguish the CoI framework from Moore's (1989) "interactions" which involve particular actors. In the CoI model, the presences are viewed more as functions that are shared among the instructor, students, and course materials. *Social presence* refers to the development of an online environment in which participants feel socially and emotionally connected with each other; *cognitive presence* describes the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse; and *teaching presence* is defined as the design, facilitation, and direction of cognitive and social processes for the realization of meaningful learning.

This chapter examines the development, application, and predictive potential of the CoI framework for course design. First, we present the conceptual development and supporting research for each of the CoI's three elements. Each of these discussions will be followed with the presentation of survey items recently developed to empirically operationalize the model and some preliminary results from studies that have used this new instrument. The chapter concludes with some recently emerging research areas for extending the CoI framework and their potential implications for online course design: epistemological and behavioral differences between academic disciplines, applications of emerging technologies, and instructor characteristics and future roles.

Conceptual Foundations of and Research on the CoI Framework

Social Presence

Social presence, the degree to which participants in computer-mediated communication feel affectively connected one to another, is the longest researched of the three presences in the CoI framework, predating the creation of the CoI model by 2 decades. Short et al. (1976) originally coined the term "social presence" to refer to the differing capacities various media have for transmitting nonverbal and vocal cues for communicating the affective and emotional (social) aspects of learning interactions. They hypothesized that users of communication media are in some sense aware of the degree of social presence of each medium and tend to avoid using particular interactions in particular media. Specifically, users avoid interactions requiring a higher sense of social presence in media that lack such capacity. Social presence, they contend, "varies among different media, it affects the nature of the interaction and it interacts with the purpose of the interaction to influence the medium chosen by the individual who wishes to communicate" (Short, Williams & Christie 1976, p. 65).

Research by Gunawardena (1995) and Gunawardena and Zittle (1997) moved the definition of social presence from its original focus on the capacities of the media involved to one that focused more on individual perceptions; in other words, the concept of "social presence" evolved to "the degree to which a person is perceived as 'real' in mediated communication" (Gunawardena and Zittle 1997, p. 8). They thus argued that social presence was more a matter of individual perceptions than an objective quality of the medium, and so the concept of "social presence" evolved to the notion of individual perceptions more common among online educators today. A number of studies followed which identify the perception of interpersonal connections with virtual others as an important factor in the success of online learning (Mays 2006; Muirhead 2001; Richardson and Swan 2003; Swan 2002; Tu 2000; Wallace 2003). By influencing interpersonal interaction within an online course, instructors can affect student attitudes and performance (Hirumi 2002, 2006) as cited in York, Yang & Dark 2007). Correspondingly, research has shown that online courses that lack meaningful interaction and/or a sense of presence can contribute to a sense of isolation, unsatisfying learning experiences, and high dropout rates (Aragon 2003; Moore and Kearsley 2004).

It is this sense of "social presence" that Garrison et al. (2000) incorporated into the CoI model. Their research team (Rourke, Anderson, Garrison & Archer 2001) looked for evidence of social presence in the transcripts of online discussion. They identified three categories of social presence indicators based on research on immediacy in face-to-face interactions (affective responses, cohesive responses, and interactive responses) and developed coding protocols using these indicators. Rourke, Anderson, Garrison & Archer (2001) established the indicators as reliable in a pilot content analysis of two online class discussions and documented the use of such indicators to project social presence in text-based online communication. Although the elements of social presence have been variously defined and the indicators and categories updated to reflect academic purposes (Garrison, Cleveland-Innes & Fung 2004), we define them as *affective expression*, where learners share personal expressions of emotion, feelings, beliefs, and values; *open communication*, where learners build and sustain a sense of group commitment; and *group cohesion*, where learners interact around common intellectual activities and tasks (Vaughan and Garrison 2006). From a methodological perspective, the three categories of social presence (personal/affective projection, open communication, and group cohesion) are used to operationalize the concept.

Richardson and Swan (2003) examined students' perceived social presence and its relationship to their perceived learning and satisfaction with course instructors. They found all three variables highly correlated, and a regression analysis showed that 42% of the variability in perceived learning was predicted by perceived social presence. Picciano (2002) investigated perceived social presence, interactivity, and learning among students enrolled in an online course and found strong correlations among these variables. While he initially found no correlations between these variables and actual performance on tests or written assignments, he discovered that, by dividing students into groups perceiving low, medium, and high social presence, there were significant differences; students in the high social presence group scored higher than the medium, and the medium group outscored the low social presence group.

Social presence has an indirect effect on teaching presence by setting the environmental conditions for higher learning; research has shown that social presence acts as a mediating variable between teaching presence and cognitive presence (Garrison, Cleveland-Innes & Fung 2010; Shea and Bidjerano 2009). Social presence affects perceived learning and persistence (Akyol and Garrison 2008; Ice, Swan, Diaz, Kupczynski & Swan-Dagen 2010) and a climate that supports questioning, reflection, and critical discourse.

Teaching Presence

Perhaps, the most significant issue is whether social presence is really a necessary precursor of cognitive presence. Most researchers in this area agree that it is, with the caveat that social presence must be directed toward learning outcomes (Garrison 2007).

Garrison, Anderson & Archer (2000) contended that while interactions between participants are necessary in virtual learning environments, interactions by themselves are not sufficient to ensure effective online learning. These types of interactions need to have clearly defined parameters and be focused toward a specific direction, hence the need for teaching presence. They describe teaching presence as the design, facilitation, and direction of cognitive social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes. Anderson, Rourke, Garrison & Archer (2001) conceptualized teaching presence as having three components: (1) instructional design and organization, (2) facilitating discourse (originally called "building understanding"), and (3) direct instruction. Although recent empirical research may generate a debate regarding whether teaching presence has two (Shea 2006; Shea and Bidjerano 2009) or three (Arbaugh and Hwang 2006) components, the general conceptualization of this CoI element has been supported by subsequent research (Arbaugh, Bangert, & Cleveland-Innes 2010; Ke 2010; LaPointe and Gunawardena 2004; Shea, Fredericksen, Pickett, & Pelz 2003; Stein, Wanstreet, Calvin, Overtoom, & Wheaton 2005).

The design and organization aspect of teaching presence has been described as the planning and design of the structure, process, interaction, and evaluation aspects of the online course (Anderson et al. 2001). Some of the activities comprising this category of teaching presence include re-creating PowerPoint presentations and lecture notes onto the course site, developing audio/video mini-lectures, providing personal insights into the course material, creating a desirable mix of and a schedule for individual and group activities, and providing guidelines on how to use the medium effectively. These are particularly important activities since clear and consistent course structure supporting engaged instructors and dynamic discussions has been found to be the most consistent predictor of successful online courses (Ke 2010; Swan 2002, 2003). Of the three components of teaching presence, this is the one most likely to be performed exclusively by the instructor. These activities are for the most part completed prior to the beginning of the course, but adjustments can be made as the course progresses (Anderson et al. 2001).

Facilitating discourse was conceptualized as the means by which students are engaged in interacting about and building upon the information provided in the course instructional materials (Anderson et al. 2001). This component of teaching presence is consistent with extensive findings supporting the importance of participant interaction in online learning effectiveness (An, Shin & Lim 2009; Arbaugh 2005b; Arbaugh and Benbunan-Fich 2007; Hratsinski 2008; Ke 2010; Sherry et al. 1998). This role includes sharing meaning, identifying areas of agreement and disagreement, and seeking to reach consensus and understanding. Therefore, facilitating discourse requires the instructor to review and comment upon student comments, raise questions, and make observations to move discussions in a desired direction, keep discussion moving efficiently, draw out inactive students, and limit the activity of dominating student posters when they become detrimental to the learning of the group (Anderson, Rourke, Garrison & Archer 2001; Brower 2003; Coppola, Hiltz, & Rotter 2002; Shea, Fredericksen, Pickett, & Pelz 2003).

Finally, direct instruction was defined as the instructor provision of intellectual and scholarly leadership in part through the sharing of his/her subject matter knowledge with the students (Anderson, Rourke, Garrison & Archer 2001). Anderson, Rourke, Garrison & Archer (2001) also contend that a subject matter expert, and not merely a facilitator, must play this role because of the need to diagnose comments for accurate understanding, injecting sources of information, and directing discussions in useful directions, thereby scaffolding learner knowledge to raise it to a new level.

In addition to the sharing of knowledge by a content expert, direct instruction is concerned with indicators that assess the discourse and the efficacy of the educational process. Instructor responsibilities are to facilitate reflection and discourse by presenting content, using various means of assessment and feedback. Explanatory feedback is crucial. Instructors must have both content and pedagogical expertise to make links among contributed ideas, diagnose misperceptions, and inject knowledge from textbooks, articles, and web-based materials.

The simultaneous roles of discussion facilitator and content expert within teaching presence go beyond early contentions that online instructors needed merely to transition from a role of knowledge disseminator to interaction facilitator. Teaching presence contends that for online learning to be effective, instructors must play both roles (Arbaugh and Hwang 2006; Ke 2010; Shea and Bidjerano 2009). Also, teaching presence's emphasis on design and organization should positively impact student satisfaction with the Internet as a delivery medium. If there is no set of activities, no timeline, no protocol, no format for course materials, and no evaluation criteria, chaos will ensue in the online environment (Berger 1999; Hiltz and Wellman 1997). Design and organization provide the context for which discourse and direct instruction have meaning.

Cognitive Presence

Cognitive presence, as conceptualized in the CoI framework, has its genesis in the work of Dewey (1933) and his notion of scientific inquiry. For Dewey, inquiry was at the core of a worthwhile educational experience. The development of the cognitive presence construct by Garrison et al. (2001) is grounded in the critical thinking literature and operationalized by the *Practical Inquiry Model* (Fig. 2) which draws on and represents a slight truncation of Dewey's model.

The Practical Inquiry Model is defined by two axes. The vertical axis reflects the integration of thought and action, reflection, and discourse. The horizontal axis represents its interface. The extremes of the horizontal axis are analysis and synthesis. These are points of insight and understanding (Garrison et al. 2000). The model also distinguishes four phases of pragmatic inquiry—triggering, exploration, integration, resolution—which the CoI model identifies as the elements of cognitive presence.

As conceptualized in the CoI model, cognitive presence begins with a *triggering event* in the form of an issue, problem, or dilemma that needs resolution. As a result of this event, there is a natural shift to *exploration*, the search for relevant information that can provide insight into the challenge at hand. As ideas crystallize, there is a move into the third phase, *integration*, in which connections are

Fig. 2 Practical Inquiry Model (Garrison et al. 2001)

made and there is a search for a viable explanation. Finally, there is a selection and testing of ideas (through vicarious or direct application) leading to *resolution*. Consistent with Dewey's rejection of dualism, the phases should not be seen as discrete or linear. However, in an actual educational experience, they are very difficult to label, as those that have used this model to code transcripts will attest (Garrison et al. 2001).

In the CoI framework, cognitive presence is defined as the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse (Garrison et al. 2001) and operationalized as the presence of its elements, the four phases of practical inquiry. Researchers have found ample evidence of practical inquiry in online discussions; however, initial studies revealed that most postings in online discussion forums were concentrated at and rarely moved beyond the exploration phase (Kanuka and Anderson 1998; Luebeck and Bice 2005; Meyer 2003, 2004; Murphy 2004; Garrison and Arbaugh 2007; Shea, Hayes, Vickers, Gozza-Cohen, Uzuner, Mehta, Valchova, & Rangan 2010).

Various explanations for the lack of integration and resolution in online discussions have been offered. One idea concerns the nature of the assignments and instructional direction provided (Garrison and Arbaugh 2007; Akyol and Garrison 2008). Indeed, studies in which students were challenged to resolve a problem with explicit facilitation and direction provided found that students did progress to resolution (Meyer 2003; Murphy 2004; Shea and Bidjerano 2008). These findings suggest that learner maturity and self-efficacy may be key factors in reaching higher levels of inquiry, prompting recent calls for the incorporation of "learner presence" into the framework (Shea and Bidjerano 2010). Another explanation suggests that practical inquiry might be initiated in discussion but reach integration and/or resolution in other parts of a course (Archer 2010). Finally, it is sometimes the case that convergent thinking, hence resolution, is not the desired outcome. Literary understanding (Langer 1990), for example, focuses on exploration and integration.

The CoI Survey

Due to the work of these researchers, the appropriateness of measuring the three types of presence exclusively by transcript analysis has increasingly come into question (Garrison and Arbaugh 2007; Shea and Bidjerano 2009). Therefore, efforts to develop supplemental or alternative measures for these constructs are underway. Most recently, the development and validation of a CoI survey instrument (see Appendix) by researchers utilizing the model has confirmed the reliability of the CoI framework and its interrelated but separate presences (Swan, Shea, Fredericksen, Pickett, Pelz, & Maher 2000). The CoI survey consists of 34 agreed upon and statistically validated items that operationalize the concepts in the CoI model (Arbaugh, Cleveland-Innes, Diaz, Garrison, Ice, Richardson, Shea, & Swan 2008). It can and is being used for continued exploration of concepts in the model and in online learning in general, and is sustaining an ongoing research agenda that supports generalizations across institutions and specific studies (Boston, Diaz, Gibson, Ice, Richardson, & Swan 2009; Shea and Bidjerano 2009). The CoI framework and survey can also be used to inform design research on the efficacy of the use of new media and emerging Web 2.0 technologies in online courses (Garrison and Akyol 2009; Ice, Curtis, Philips, & Wells 2007; Ice, Swan, Diaz, Kupczynski, & Swan-Dagen 2010; Shea and Bidjerano 2009).

The CoI survey may also be used for practical purposes—to guide design elements ahead of time or to evaluate their success in supporting the development of an online CoI, once implemented—in that items in the survey provide insights into the necessary practice-based requirements of each presence (Ice 2009a, b).

Cognitive Presence Items in CoI Survey

If one assumes that responses to the 12 cognitive presence items in the CoI survey provide a reasonable snapshot of the thinking and learning processes occurring in an online course, then it is clear that these items can be used to evaluate course designs relative to their support for the development of cognitive presence. It is also clear that one can design to them. For example, the triggering event items suggest that designers must provide learners with interesting problems, discussion questions, and task-related activities to engage them in the inquiry process. The resolution items suggest that such problems, discussions, and/or activities need to be authentic and linked to the learners' practice for them to stay engaged through to resolution. Similarly, the exploration items point to the importance of providing learners with opportunities to brainstorm and discuss issues and ideas, encouraging them to use and search for information to support their inquiries and positions. The integration items can be used to develop activities that require reflection, the integration of ideas, and the development of explanations and problem solutions.

In any case, it can be argued that the elements of cognitive presence as defined in the CoI framework provide a reasonably complete catalog of the thinking and learning processes that take place in a collaborative constructivist environment. As such, they can be used to guide course design and implementation and to evaluate how successful design and implementation are in eliciting cognitive presence. Thus, instructional designers and/or course instructors who want to foster open communication can focus on providing opportunities for students to become comfortable conversing, participating, and interacting in online course discussions and can measure their success in so doing using the three related CoI survey items.

Social Presence Items in CoI Survey

By supposing that the nine social presence items included within the CoI survey provide a reasonable representation of the necessary and relevant social interactions necessary in online courses for effective learning, we can use them to evaluate course designs and related implications. For example, Boston et al. (2009) used the CoI instrument as a means to examine student retention in online courses. Correspondingly, we can also use the indicators or items to design effective online courses. While the activities presented as suggestions may overlap among the three categories, following are some suggestions for designers. When designing for *affective expressions*, designers should consider including initial course activities to encourage the development of swift trust, such as introductory and short content-related videos, places for student and peer interaction (e.g., "meet your classmates" and "study lounges"), real-time communications (e.g., chat, collaborative whiteboards, interactive video), or social software (e.g., *blogs*, *wikis*, *YouTube, Flickr, MySpace*, *Second Life*). For *open communication*, designers should require discussion participants to respond to their classmates postings, make participation in discussion a significant part of course grades (e.g., if we value the discussion, students will value it), consider how to explicitly introduce students to the unique nature and learning potential of online discussion, establish rules of Netiquette, and incorporate journaling or blogging so that students, peers, and instructors can interact on an individual and personal basis. Finally, for *group cohesion*, activities in addition to those already mentioned can include the development and integration of community building activities and collaborative activities such as problem-solving tasks, projects, and small group discussion.

Teaching Presence Items in CoI Survey

Understanding the application of the teaching presence items to practice is critical for realizing effective outcomes in online courses. In work by Staley and Ice (2009), the importance of the instructional design and organization construct was found to be directly related to the resolution phase of cognitive presence. This research demonstrated a clear relationship between adequately setting forth expectations and the ability of students to readily achieve higher-order thought outcomes. In related work, the importance of robust instructional design and organization was found to be particularly important with respect to those new to online learning and certain ethnic minorities (Kupczynski, Davis, Ice, & Callejo 2008).

With respect to facilitation of discourse, it is important for instructors to remain true to the conceptual foundation of the CoI and ensure that their actions during the discussion process be in alignment with a collaborative constructivist paradigm. When instructors' actions deviate from this premise and align more closely with an objectivist orientation, research has demonstrated that students do not engage as frequently in higher-order thought processes. Rather, when learning takes on an objectivist orientation, with commensurate lack of constructivist instructor interaction, students perceive outcomes in much more quantifiable terms and a lack of higher-order thought is prevalent (Akyol, Ice, Garrison, & Mitchell 2010). However, insuring such outcomes may require a significant institutional commitment as instructors who do not have significant experience in online teaching may not understand appropriate techniques for applying a constructivist approach (Phillips, Wells, Ice, Curtis, & Kennedy 2007). Program evaluations assessing the impact of using the CoI as a training tool have illustrated that when institutions apply adequate resources to faculty awareness and training initiatives, increased perceptions of resolution, overall student satisfaction, and faculty satisfaction manifest quickly (Powell and Ice 2010).

Research Findings on the CoI

A good deal of important research on online learning has utilized the CoI framework. For example, research has found that perceptions of social presence are linked to student satisfaction in online courses (Gunawardena and Zittle 1997, Tu and McIsaac 2002; Richardson and Swan 2003), as well as to students' perceived and actual learning from them (Walther 1992; Gunawardena 1995; Picciano 2002; Richardson and Swan 2003). It suggests that, while social presence alone will not ensure the development of critical discourse in online learning, it is extremely difficult for such discourse to develop without a foundation of social presence (Celani and Collins 2005; Garrison and Cleveland-Innes 2005; Molinari 2004).

Liu, Gomez, & Yen (2009) conducted a predictive quantitative research design to examine the predictive relationships between social presence and course retention, as well as final grade in community college online courses. The results of their study suggest that social presence is a significant predictor of course retention and final grade in the community college online environment. They recommended "actions for community colleges and online educators to improve the likelihood of student success in an online learning environment including early identification of at-risk students and effective interventions such as building effective blended learning programs and developing integrated social and learning communities" (p. 173).

Boston et al. (2009) explored the relationship between indicators of the CoI framework and student persistence at a fully online university ($n = 28{,}877$). Their findings demonstrated a significant amount of variance (18%) in student reenrollment (with whether a student returned to studies in the semester subsequent to completing the survey) that could be accounted for by indicators of social presence. They suggest that students attending fully online universities seek social interaction primarily online. As a result, faculty may need to redesign their curriculum to provide opportunities that allow students to engage with one another online. As educators continue to develop interventions to promote retention, they should pay particular attention to how the institution encourages interaction among its students.

Researchers in the field have also documented strong correlations between learners' perceived and actual interactions with instructors and their perceived learning (Swan et al. 2000; Jiang and Ting 2000; Richardson and Swan 2003), and between all three elements of teaching presence and student satisfaction and perceived learning in online courses (Shea, Pickett, & Pelz 2004). Teaching presence has been shown to be linked to the development of a sense of community in online courses (Shea, Li, Swan, & Pickett 2005), and the body of evidence attesting to the critical importance of teaching presence for successful online learning is quite large (Garrison and Cleveland-Innes 2005; Meyer 2003; Murphy 2004; Swan and Shih 2005; Vaughan and Garrison 2006; Wu and Hiltz 2004).

Due in part to the creation of the CoI survey, recent studies have begun to examine the three types of presence simultaneously. These studies have found support for the coexistence of the three presences and their ability to predict course outcomes (Arbaugh 2008; Bangert 2009; Garrison, Cleveland-Innes, & Fung 2010; Ke 2010; Nagel and Kotze 2010; Shea and Bidjerano 2009). These studies generally have supported earlier arguments that teaching presence is a foundational element for the development of both social and cognitive presence, and progressing to more advanced stages of cognitive presence is challenging but possible (Archibald 2010; Ke 2010; Shea and Bidjerano 2010). These studies also suggest that the predictive ability of the framework may extend beyond text-based learning environments to more immersive online learning environments such as Second Life (Burgess, Slate, Rojas-LeBouef, & LaPrarie 2010; Traphagan, Chiang, Chang, Wattanawaha, Lee, Mayrath, Woo, Yoon, Jee, & Resta 2010). Such supportive findings and extensions of the CoI framework raise questions regarding other characteristics that may influence and be influenced by the framework with resulting implications for course design. In the next section, we will discuss three such areas: (1) fostering of meaningful inquiry and deep learning, (2) integrating emerging educational technologies, and (3) considering academic disciplines of varying epistemological and behavioral educational practices.

Emerging Design Topics for CoI Integration

Fostering Meaningful Inquiry and Deep Learning

Recent research utilizing the CoI survey identifies teaching presence as a necessary prerequisite for the development of social and cognitive presence (Shea and Bidjerano 2008). From this perspective, researchers that are focusing on the CoI have developed a different lens from which to view the framework in terms of instructional design approaches. Specifically, a set of seven instructional design principles were developed based on utilizing the three subcategories of teaching presence—design, facilitation, and instruction—to support the development of social and cognitive presence (Garrison 2009):

1. Design for open communication and trust
2. Design for critical reflection and discourse
3. Create and sustain a sense of community
4. Support purposeful inquiry
5. Ensure that students sustain collaboration
6. Ensure that inquiry moves to resolution
7. Ensure assessment is congruent with intended learning outcomes

The activity components listed above move the idea of an online CoI into concrete activity plied by online instructors. These activities cluster around design and organization, direct instruction, and facilitation. We do not discount the valued contribution of instructional designers; in fact, this support for online instructors in higher education is likely to become more prevalent as technology becomes more complex. In any case, the instructor remains the central voice in the design and is the organizer or manager of the course as it unfolds. Direct instruction and facilitation are integrated into design and organization activities as the need arises throughout the course.

In this time of early adoption of online learning, instructors also perform the job of orienting students to the role of online learner. Students require new skills to be competent online learners, playing with learner activities from f2f environments and trying new ones. Online learner skills include the ability to be socially and cognitively present (Garrison and Cleveland-Innes 2005) by interacting with others, sharing experiences and demonstrating exploration, and integrating and applying-content knowledge. This requires the ability to overcome limitations in social and academic interaction caused by a lack of visual and verbal cues available in face-to-face learning. This interaction is central to the creation of an online CoI and all it subcomponents. Without this skill, not matter what the instructor does, understanding content and constructing knowledge will be limited to what one can foster on one's own (Picard 1997; Rice 1992).

Activities that support student adjustment to online environments may play a dual role in the support of key activities in the development of a CoI. An online CoI emerges out of the presentation of teaching, social and cognitive presence on the part of students and instructor, such that meaningful inquiry and deep learning occur.

Collaborative constructivism is the philosophical foundation of the CoI framework, grounded in the research on deep and meaningful approaches to learning (Cleveland-Innes and Emes 2005; Garrison, Anderson & Archer 2000). An inquiry approach to learning offers the process of thoughtful consideration as an outcome as well as knowledge gains: "If we turn from normal academic practice to the inquiry paradigm of academic practice, we note that there is no longer a need to inculcate a set of substantive beliefs disguised as 'knowledge.' Instead, students are asked to accept in a tentative, provisional way the methodology of inquiry" (Lipman 1991, p. 144).

Deep learning reflects the intention to extract meaning through active learning processes such as relating ideas, looking for patterns, using evidence, and examining the logic of argument. While resting first on personal intention, deep learning is fostered through modeling, expectation, debate, and appropriate assessment (Entwistle 2000). For Lipman (1991) and Garrison et al. (2001), collaborative constructivism leading to deep learning occurs most readily in a learning community. This, then, is the first order of development for an online instructor. In order to do this, the following design components must be considered.

Design for Open Communication and Trust. Little has been studied as much or as thoroughly as the modern concept of community and the changes occurring in human community based on social organizational changes and technology. In extensive research, Bruhn (2005) determined that community forms through the links created between the individuals in that community. In order for these links or relationships to form, the opportunity for open communication expressed in a trusting or safe environment, course design must make these opportunities available (Swan and Shih 2005; Tu and McIsaac 2002). Open communication and trust are functions of teaching presence (Cleveland-Innes et al. 2009) and, in particular, teacher behavior (Shea, Li, Swan, & Pickett 2005; Shea and Bidjerano 2009).

Design for Critical Reflection and Discourse. For online learning to become a sound educational environment, course activity must be designed to require interaction activity beyond "undirected, unreflective, random exchanges and dumps of opinions" (Garrison et al. 2000, p. 15). Like open communication, this cognitive engagement is dependent upon teaching presence (Cleveland-Innes et al. 2009; Cleveland-Innes, Vaughan, & Garrison 2010) and well-defined, agreed-upon roles for students and instructors (Rourke and Kanuka 2007). It is critical reflection and discourse that move students through the full process of practical inquiry. To accomplish this, course design must include a "means for reducing structure and increasing dialogue so that learners may move from being simply recipients of knowledge to actively embracing and working with objective knowledge to make it their own" (Lauzon 1992, p. 34) such that critical thinking may emerge (Bullen 1998). Course design must include interaction activities that are both dialogic (Gunawardena et al. 2001; Pena-Shaff and Nicholls 2004) and dialectic (Nussbaum 2008). Without both types of supported interaction, critical debate and cognitive resolution will be limited.

Create and Sustain a Sense of Community. Early definitions of community were based on geography, referring to a group who existed in a particular place. It holds the necessity of interaction among community members around a mutual purpose, an awareness of their commonalities, and some common rules of operation. Long before Hillery, Durkheim (1933) noted the shortcomings of defining community based solely on geography: "To be sure, each of us belongs to a commune or department, but the bonds attaching us become daily more fragile and more slack. These geographical divisions are, for the most part, artificial and no longer awaken in us profound sentiments" (pp. 27–28). Mutuality has become a defining characteristic of community: "Community is a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (McMillan and Chavis 1986, p. 9).

To garner this commitment in a short-term online community as part of a temporary learning environment requires careful planning and implementation, as productive online learning communities do not emerge spontaneously (Wood 2003). In a position of authority and leadership, an online instructor must respond to students such that they feel part of a purposeful CoI and learning. Meaningful discourse and reflection should be modeled and rewarded with encouragement and acknowledgment. This must go beyond just the instructor–student dialogue to student-to-student dialogue—watch for it, support it, and remind them to engage in deep and meaningful discussion. The instructor must foster a dynamic relationship between students and the community they support (Moisey, Neu, & Cleveland-Innes 2008).

Whether online or otherwise, "education is best experienced within a community of learning where competent professionals are actively and cooperatively involved with creating, providing, and improving the instructional program" (Sonwalkar, Flores, & Gardner 2010, p. 37). Building community online requires usual elements of building community: leadership, rules of operation, social norms, and relationships among community members (Kim 2000; Paloff and Pratt 1999). The stronger the ties between the members of the community, the more salient and engaged the community. The development of an online community, with required support for earners adjusting to their new role, requires thoughtful and deliberate action on the part of those engaged in the creation and facilitation of online courses (Willment and Cleveland-Innes 2002).

Ensure that Students Sustain Collaboration. Facilitation goes beyond support for community to sustaining collaboration within that community. It is not simply the community itself that fosters learning but collaborative, constructivist activities within the community that is most important. These activities foster and sustain community, but most importantly, this is where knowledge is shared and developed. Facilitating this collaboration can be achieved by requiring group activities and collaborative interaction through discourse and debate.

Support Purposeful Inquiry. Instructors have the opportunity to support purposeful inquiry by making desired outcomes explicit (hence purposeful) and posing critical questions (to encourage inquiry). The Practical Inquiry Model identifies four phases in the inquiry process (Garrison et al. 2001): definition of a problem or task, exploration for relevant information/knowledge, making sense of and integrating ideas, and testing plausible solutions. All of these occur in an environment of reflection and discourse, analysis, and synthesis.

Ensure that Inquiry Moves to Resolution. Progression through the inquiry cycle requires well-designed learning activities, facilitation, and direction. Although the online CoI recommends acceptance of the open and tentative nature of knowledge, moving students toward intellectual resolution, at least temporarily, is highly desired. Early research of practical inquiry in online environments found little evidence of students moving to the resolution phase (see for example, Fahy, Crawford, & Ally 2001). This highlighted the issue, and further research has been done.

Integration and Resolution are More Demanding than Exploration. Meyer (2003) suggests that increased time for reflection is required and that faculty may have to insist that resolution be achieved. What is now supported by research is that the role of the instructor, and the activities that instructor requires of students, will either move students toward resolution or not: "When questions specifically asked students to engage in practical applications, discussions did progress to the synthesis and resolution phase" (Garrison and Arbaugh 2007, p. 162).

Ensure Assessment is Congruent with Intended Learning Outcomes. Assessment activities reveal what is valued and shape how students approach their learning. Evaluation consistent with the intention to engage in meaningful inquiry shows a positive effect on deep approach to learning across time (Cleveland-Innes and Emes 2005; Andrews et al. 1996). In other words, if students are evaluated by recall of facts without application or critique, students will resist approaches that encourage critical discourse and reflection. They will expect the instructor to simply present the content in a timely and clearly structured manner. Deep approaches to learning are associated not only with appropriate assessment but teaching presence in the form of facilitation and choice (Entwistle and Tait 1990). Assessment shapes the quality of learning and the quality of teaching. In short, students do what is rewarded. For this reason, one must be sure to reward activities that encourage deep and meaningful approaches to learning. Feedback can be effectively provided in a face-to-face or online context. Online discussion boards are one mechanism. Summative evaluation, on the other hand, is about assessment of competence. Summative assessment makes a judgment, based on quantitative and qualitative data, about achievement related to intended learning outcomes. If the intended learning outcomes are deep and meaningful learning, then assessment must be based on assignments that encourage critical thinking and inquiry. Such assignments can be analysis of case studies, article reviews, and individual or collaborative projects.

Grading collaborative assignments is more complex. Tensions and inequities may arise in terms of individual contributions. For this reason, consideration should be given to having students work collaboratively to a point but then submitting individual assignments based on different perspectives or components of a larger problem. Even though students submit individual assignments, the group may, for example, do a collaborative presentation with a grade assigned for the group (Cleveland-Innes et al. 2010).

The CoI and Emerging Technologies

From the earliest forays into online learning, critics of the medium have contended that because interactions occur in a disembodied form, a lack of nuance can lead to loss of meaning for participants (Bullen 1998). As such, it is argued that asynchronous learning is not sufficiently rich in the socially mediated practice that Vygotsky (1978) described as necessary to construct knowledge. However, this narrow interpretation of Vygotsky discounts the ability of learners to conceptualize "being" as anything other than a physical construct.

The ability of a medium to fully support interpersonal communication was initially termed social presence by Short et al. (1976), who proposed that the inability of low bandwidth media to transmit verbal and nonverbal information directly impacted the degree to which presence was perceived. Researchers familiar with online discussion forums, however, not only contested this notion, arguing that presence was a perceptual not a physical quality (Gunawardena and Zittle 1997; Walther 1992), but also appropriated the term "social presence" in their research (Anderson et al. 2001; Swan 2002). Following this premise, considerable research has been conducted illustrating that high degrees of social presence, as well as teaching and cognitive presence, can be achieved in text-based environments (Akyol et al. 2009).

As learning technologies have proliferated over the last few years, the ability to enhance each of the three presences has dramatically increased. However, for practitioners, this proliferation has also created considerable ambiguity in selecting and implementing effective solutions. Here, the CoI survey has proven to be extremely useful as it provides a means for testing the efficacy of new technologies against normative online techniques and pedagogical strategies.

After initial work on the efficacy of audio feedback, Ice (2008) used the CoI survey to compare a multi-institutional sample in which participants provided audio feedback to samples in which text-back feedback was utilized. Analysis clearly demonstrated gains in all three presences and statistically significant gains on four teaching presence, one social presence, and two cognitive presence survey items. Emerging work by Greivenkamp, Stoll, & Johnston (2009) using Adobe Captivate to capture both the visual and auditory components found students more effectively contextualize mixed medium feedback, with significant gains in cognitive presence, findings later validated in a larger study by Ice, Swan, Diaz, Kupczynski, & Swan-Dagen (2010).

In separate work, Ice (2009b) used the CoI to design a rubric around the exploration, integration, and resolution elements of cognitive presence to assess differences in desktop versus software as a service (SaaS) document creation tools. In this study, SaaS word processors were found to increase instances of indicators at all levels, with gains in resolution with SaaS being over two to one as opposed to when desktop word processors were used.

With respect to Rich Internet Applications (RIAs), Bain and Ice (2009) administered the CoI survey to students exposed to thematically similar content in both static and dynamic formats (including RIAs). Though the sample size was small (58), the findings revealed significant gains on 18 of the 34 indicators. Interestingly, there was also a decrease in two of the items for the dynamic format group. As such, the CoI has provided significant insight into both the strengths and weaknesses of this general class of technologies.

As noted earlier, there are initial studies that examine the applicability of the CoI in Second Life. Albeit with a sample of ten learners, Burgess, Slate, Rojas-LeBouef,

& LaPrarie (2010) found that respondents rated the Second Life environment highly for each of the three types of presence. In a comparative study of 12 learners using Second Life and text-based synchronous chat in an online course, Traphagan, Chiang, Chang, Wattanawaha, Lee, Mayrath, Woo, Yoon, Jee, & Resta (2010) found no differences between the mediums for social and teaching presence but found that learners demonstrated higher levels of cognitive presence in synchronous chats. They found differences in cognitive presence because participants were able to establish collaborative discourse patterns and got used to the tools during chat sessions, whereas Second Life's user interface and visual info were difficult to use and distracting. Considering that participants in this study were first time users of Second Life, there is at least the potential that relative learner experience with the technology may have confounded these findings. These initial studies suggest that there is potential for the CoI framework to be generalizable to immersive learning environments.

While supporting research is certainly needed, the CoI survey instrument has proven very beneficial in the above studies. Systematic utilization of this methodology can significantly reduce uncertainty regarding the efficacy of implementing new technologies and associated costs. From a pedagogical perspective, there is also a great deal to be gained from exploration of areas in which promising implementations can be used to enhance the potential of online learning.

Having an emerging theoretical framework such as the CoI to guide instructors and institutions on the introduction of new technologies may prove both beneficial and efficient. The historical instructional design and technology literature is replete with examples of how "the next big thing" in instructional technology arrives before we fully understand how to use the current "big thing" effectively (Saettler 1990). Indeed, if anything, potential new applications are likely to mushroom during the next decade, potentially rendering current tools obsolete (Ice 2010). Therefore, a lens from which emerging technologies can be seen for their contribution to the learning environment, such as the CoI, rather than merely their technological sizzle can help educational providers make more informed and efficient adoption decisions.

Disciplinary Differences and the CoI Framework

A third area of potential integration with the CoI with implications for design decisions is epistemological and behavioral differences in learning and education across academic disciplines. To date, the literature on disciplinary differences has had little influence on the online learning literature. Historically, researchers and practitioners of online learning have, for the most part, tended to treat course content as a constant (Arbaugh 2005a) and seek approaches to online learning effectiveness that are applicable regardless of discipline (Gorsky and Caspi 2005; Helmi, Haynes, & Maun 2000). In response to increasing interest in the integration of content and pedagogical knowledge (Mishra and Koehler 2006), discipline-specific applications of technology to education (Neumann, Parry, & Becher 2002), and Wallace's (2003) call for research on subject matter effects in online learning, researchers are beginning to

Table 1 Academic discipline categories and selected characteristics

Level of paradigm development		
Emphasis on application	Hard	Soft
Pure	Cumulative; atomistic (crystalline/tree-like); concerned with universals; resulting in discovery/explanation. *Examples: Mathematics, Physical Sciences*	Reiterative; holistic (organic/river-like); concerned with particulars; resulting in understanding/interpretation. *Examples: Humanities, Social Sciences*
Applied	Purposive; pragmatic (know-how via hard knowledge); concerned with mastery of physical environment; resulting in products/techniques. *Examples: Engineering, Architecture*	Functional; utilitarian (know-how via soft knowledge); concerned with enhancement of (semi-) professional practice; resulting in protocols/procedures. *Examples: Education, Nursing*

Sources: Arbaugh, Bangert, & Cleveland-Innes (2010), Becher (1994), Biglan (1973a, b), Neumann (2001), Neumann Parry, & Becher (2002), Smith, Heindel, & Torres-Ayala (2008)

examine the influence of disciplinary effects on course outcomes. In a study of courses conducted at the University of South Florida between 2002 and 2007, Smith, Heindel, & Torres-Ayala (2008) found substantial variation across disciplines in the usage of various components of the Blackboard course management system. They found that the use of document creation, dropbox, and messaging tools increased markedly in courses from applied disciplines, such as Engineering, Nursing, and Education, and declined markedly in courses from pure disciplines, such as Natural Sciences, Humanities, and Mathematics. In another recent study, Hornik, Sanders, Li, Moskal, & Dziuban (2008) examined data from 13,000 students in 167 courses from 1997 to 2003. Using Kuhn's (1970) model of paradigm development to frame disciplines, they found that student grades were higher and withdrawals were lower for subjects with high paradigm development, such as the hard sciences, nursing, and health services, than for those subjects with less fully developed paradigm development, such as the social sciences, humanities, information systems, and political science. Such variance in course design, conduct, and outcomes suggests that disciplinary perspectives warrant much further consideration when contemplating the development of an online business education program.

With scholarly roots in the sociology and history, researchers have been studying disciplinary differences in higher education for about 40 years (Kuhn 1970; Lohdahl and Gordon 1972; Thompson et al. 1969). Although much of this literature is devoted to identifying and examining sociological and behavioral differences across disciplines (Becher 1994; Becher and Trowler 2001; Hativa and Marincovich 1995; Lattuca and Stark 1994; Shulman 1987, 2005; Smeby 1996), to date, epistemological differences have been the primarily adopted characteristic from this literature for use in other educational research. One of the more popular epistemological frameworks for distinguishing differences between academic disciplines was developed by Biglan (1973a). Biglan's framework categorizes academic disciplines based on their positioning along three dimensions: (1) the existence of a dominant paradigm, (2) a concern with application, and (3) a concern with life systems. These dimensions have come to be operationalized as hard/soft, pure/applied, and life/nonlife, respectively. Although recent research seeks to revive interest in the life/nonlife dimension (Arbaugh et al. 2010; Laird, Shoup, Kuh, & Schwartz 2008), most of the subsequent research using Biglan's framework has focused on the paradigm dominance and emphasis on application dimensions. A representation of these dimensions and the characteristics commonly associated with them is presented in Table 1.

Hard disciplines are characterized by coalescence around dominant paradigms. In other words, scholars in these fields have general agreement regarding "how the world works." Conversely, soft disciplines are characterized by having multiple competing paradigms available as possible explanations of their phenomena of interest. Pure fields place more attention on knowledge acquisition, whereas application and integration receive stronger emphasis in applied fields.

"Hard, applied, nonlife" disciplines call for progressive mastery of techniques in linear sequences based upon factual knowledge. Students in "hard, applied" disciplines are expected to be linear thinkers. Teaching activities *generally are* focused and instructive, with the primary emphasis being on the teacher informing the student (Neumann 2001; Neumann, Parry, & Becher 2002). Emphasis on factual knowledge, and by extension examinations, extends from "hard, pure" to "hard, applied" disciplines, although problem-solving will be emphasized more in the "hard, applied" disciplines. Therefore, quantitatively oriented assignments and examinations are the primary means of assessing student learning (Neumann 2003). Conversely, teaching in "soft, applied, life" disciplines will be more free ranging, with knowledge building being a formative process where teaching and learning activities tend to be constructive and reiterative, shaped by practically honed knowledge and espoused theory. Students are expected to be more lateral in their thinking. As is the case in the field of education, scholars of educational practice in these disciplines are encouraged to refer to class participants as learners rather than students (Johnson and Johnson 2009). In the softer disciplines, essays and group projects dominate, and self-assessments are common (Neumann 2003). Because of the emphasis on developing practical skills, there is a greater need for constructive informative feedback on assessments. Emphasis on widely transferrable skills will be greater in "soft, applied" disciplines than "hard, applied" ones, as will reflective practice and lifelong learning.

These epistemological and pedagogical differences between disciplines suggest that courses in these areas should be designed differently for delivery in online and blended environments. However, such differences often are not factored into discussions of the design of online and blended courses. In fact, the contemporary instructional design literature often notes how discipline-related issues are to be left to "subject matter experts" (Dempsey and Van Eck 2002; Merrill 2001). Consideration of such disciplinary differences also carries implications for the broader application of the CoI framework. For example, consider how disciplinary differences may impact the prioritization of the components of teaching presence. With the emphasis on factual knowledge associated with "hard" disciplines, instructors should place more emphasis on direct instruction than facilitating discourse. Conversely, instructors in "soft" disciplines should place more emphasis on facilitation. Course design and organization would remain a priority in either setting, but the focus of design and organization efforts may change. Instructors in "soft" disciplines would focus on refining expectations for participation and "netiquette," while instructors in hard disciplines would focus more on the design and presentation of content. Considering the increasing importance being attributed to the role of teaching presence in fostering social presence, such implications suggest, at minimum, that there will be discipline-based differences in the development of social presence, or even that the requirement of social presence for successful online learning may turn out to be discipline specific.

Disciplinary differences also may have direct implications for research into cognitive presence. The lack of progression to higher stages of cognitive presence in online learning has long been mentioned as a cause for concern. Although some of these concerns may be alleviated by expanding measures of cognitive presence beyond course discussion transcript analysis (Garrison and Arbaugh 2007; Shea and Bidjerano 2009; Shea et al. 2010), could it also be that at least some of this lack of progression may be discipline-related? "Applied" disciplines by definition are seeking to link their courses and content toward application, whereas such an orientation is a lesser priority in "pure" disciplines (Neumann 2003; Stark 1998). In fact, recent preliminary research suggests such differences in attainment of cognitive presence may exist (Arbaugh et al. 2010; Shea et al. 2010). Therefore, online teaching and learning researchers should be giving increased attention to the integration of disciplinary effects and the CoI to provide educators insights into the effective design of their courses.

Appendix: Community of Inquiry Survey Items[1]

Teaching Presence

Design and Organization

1. The instructor clearly communicated important course topics.
2. The instructor clearly communicated important course goals.
3. The instructor provided clear instructions on how to participate in course learning activities.
4. The instructor clearly communicated important due dates/time frames for learning activities.

Facilitation

5. The instructor was helpful in identifying areas of agreement and disagreement on course topics that helped me to learn.

[1] Based on a 5-point Likert-type scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

6. The instructor was helpful in guiding the class toward understanding course topics in a way that helped me clarify my thinking.
7. The instructor helped to keep course participants engaged and participating in productive dialogue.
8. The instructor helped keep the course participants on task in a way that helped me to learn.
9. The instructor encouraged course participants to explore new concepts in this course.
10. Instructor actions reinforced the development of a sense of community among course participants.

Direct Instruction

11. The instructor helped to focus discussion on relevant issues in a way that helped me to learn.
12. The instructor provided feedback that helped me understand my strengths and weaknesses.
13. The instructor provided feedback in a timely fashion.

Social Presence

Affective Expression

14. Getting to know other course participants gave me a sense of belonging in the course.
15. I was able to form distinct impressions of some course participants.
16. Online- or web-based communication is an excellent medium for social interaction.

Open Communication

17. I felt comfortable conversing through the online medium.
18. I felt comfortable participating in the course discussions.
19. I felt comfortable interacting with other course participants.

Group Cohesion

20. I felt comfortable disagreeing with other course participants while still maintaining a sense of trust.
21. I felt that my point of view was acknowledged by other course participants.
22. Online discussions help me to develop a sense of collaboration.

Cognitive Presence

Triggering Event

23. Problems posed increased my interest in course issues.
24. Course activities piqued my curiosity.
25. I felt motivated to explore content-related questions.

Exploration

26. I utilized a variety of information sources to explore problems posed in this course.
27. Brainstorming and finding relevant information helped me resolve content-related questions.
28. Discussing course content with my classmates was valuable in helping me appreciate different perspectives.

Integration

29. Combining new information helped me answer questions raised in course activities.
30. Learning activities helped me construct explanations/solutions.
31. Reflection on course content and discussions helped me understand fundamental concepts in this class.

Resolution

32. I can describe ways to test and apply the knowledge created in this course.
33. I have developed solutions to course problems that can be applied in practice.
34. I can apply the knowledge created in this course to my work or other non–class related activities.

References

Akyol, Z., Arbaugh, J. B., Cleveland-Innes, M., Garrison, D. R., Ice, P., Richardson, J., & Swan, K. (2009). A response to the review of the community of inquiry framework. *Journal of Distance Education, 23*(2), 123–136.

Akyol, Z., & Garrison, D. R. (2008). The development of a community of inquiry over time in an online course: Understanding the progression and integration of social, cognitive and teaching presence. *Journal of Asynchronous Learning Networks, 12*(3–4), 3–22.

Akyol, Z., Ice, P., Garrison, D. R., & Mitchell, R. (2010). The relationship between course socio-epistemological orientations and student perceptions of the community of inquiry. *The Internet and Higher Education, 13*(1–2), 66–68.

Allen, I. E., & Seaman, J. (2010). *Learning on demand: Online education in the United States 2009*. Wellesley, MA: Babson Survey Research Group.

An, H., Shin, S., & Lim, K. (2009). The effects of different instructor facilitation approaches on students' interactions during asynchronous online discussions. *Computers in Education, 53*, 749–760.

Anderson, T., Rourke, L., Garrison, D., & Archer, W. (2001). Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks, 5*(2), 1–17.

Andrews, J., Garrison, D. R., & Magnusson, K. (1996). The teaching and learning transaction in higher education: A study of excellent professors and their students. *Teaching in Higher Education, 1*, 81–103.

Aragon, S. R. (2003). Creating social presence in online environments. *New Directions for Adult and Continuing Education, 2003*(100), 57–68.

Arbaugh, J. B. (2005a). How much does "subject matter" matter? A study of disciplinary effects in web-based MBA courses. *The Academy of Management Learning and Education, 4*, 57–73.

Arbaugh, J. B. (2005b). Is there an optimal design for on-line MBA courses? *The Academy of Management Learning and Education, 4*, 135–149.

Arbaugh, J. B. (2008). Does the community of inquiry framework predict outcomes in online MBA courses? *International Review of Research in Open and Distance Learning, 9*, 1–21.

Arbaugh, J. B., Bangert, A., & Cleveland-Innes, M. (2010). Subject matter effects and the community of inquiry (CoI) framework: An exploratory study. *The Internet and Higher Education, 13*, 37–44.

Arbaugh, J. B., & Benbunan-Fich, R. (2007). Examining the influence of participant interaction modes in web-based learning environments. *Decision Support Systems, 43*, 853–865.

Arbaugh, J. B., Cleveland-Innes, M., Diaz, S. R., Garrison, D. R., Ice, P., Richardson, J. C., Shea, P., & Swan, K. (2008). Developing a community of inquiry instrument: Testing a measure of the community of inquiry framework using a multi-institutional sample. *The Internet and Higher Education, 11*(3–4), 133–136.

Arbaugh, J. B., & Hwang, A. (2006). Does "teaching presence" exist in online MBA courses? *The Internet and Higher Education, 9*, 9–21.

Archer, W. (2010). Beyond online discussion: Extending the community of inquiry framework to entire courses. *The Internet and Higher Education, 13*(1–2), 69.

Archibald, D. (2010). Fostering the development of cognitive presence: Initial findings using the community of inquiry survey instrument. *The Internet and Higher Education, 13*(1–2), 73–74.

Bain, B., & Ice, P. (2009, October). *Using RIA's to enhance student engagement and cognitive outcomes.* In Paper presented at Adobe MAX 2009, education preconference symposium, Los Angeles, CA.

Bangert, A. W. (2009). Building a validity argument for the community of inquiry instrument. *The Internet and Higher Education, 12*, 104–111.

Becher, T. (1994). The significance of disciplinary differences. *Studies in Higher Education, 19*, 151–161.

Becher, T., & Trowler, P. R. (2001). *Academic tribes and territories* (2nd ed.). Berkshire, UK: Society for Research into Higher Education & Open University Press.

Berger, N. S. (1999). Pioneering experiences in distance learning: Lessons learned. *Journal of Management Education, 23*, 684–690.

Biglan, A. (1973a). The characteristics of subject matter in different academic areas. *The Journal of Applied Psychology, 57*(3), 195–203.

Biglan, A. (1973b). Relationships between subject matter characteristics and the structure and output of university departments. *The Journal of Applied Psychology, 57*, 204–213.

Boston, W., Diaz, S. R., Gibson, A. M., Ice, P., Richardson, J., & Swan, K. (2009). An exploration of the relationship between indicators of the community of inquiry framework and retention in online programs. *Journal of Asynchronous Learning Networks, 13*(3), 67–83.

Retrieved October 6, 2009 from http://www.aln.org/publications/jaln/index.asp?op0=OR&filter0%5B%5D=1296.

Brower, H. H. (2003). On emulating classroom discussion in a distance-delivered OBHR course: Creating an on-line community. *The Academy of Management Learning and Education, 2*, 22–36.

Bruhn, J. G. (2005). *The sociology of community connection*. New York, NY: Springer.

Bullen, M. (1998). Participation and critical thinking in online university distance education. *Journal of Distance Education, 13*(2), 1–32. Retrieved June 21, 2010 from http://cade.athabascau.ca/vol13.2/bullen.html.

Burgess, M. L., Slate, J. R., Rojas-LeBouef, & LaPrarie, K. (2010). Teaching and learning in second life: Using the community of inquiry (CoI) model to support online instruction with graduate students in instructional technology. *The Internet and Higher Education, 13*(1–2), 84–88.

Celani, M. A. A., & Collins, H. (2005). Critical thinking in reflective sessions and in online interactions. *AILA Review, 18*, 41–57.

Cleveland-Innes, M., & Emes, C. (2005). Principles of a learner centered curriculum: Responding to the call for change in higher education. *The Canadian Journal of Higher Education, 35*(4), 85–110.

Cleveland-Innes, M., Garrison, D. R., & Kinsel, E. (2007). Role adjustment for learners in an online community of inquiry: Identifying the challenges of incoming online learners. *International Journal of Web-Based Learning and Teaching Technologies, 2*(1), 1–16.

Cleveland-Innes, M., Vaughan, N., & Garrison, D. R. (2010, June). Design in online and blended learning. In *International conference on blended learning, Webinar*.

Coppola, N. W., Hiltz, S. R., & Rotter, N. G. (2002). Becoming a virtual professor: Pedagogical roles and asynchronous learning networks. *Journal of Management Information Systems, 18*(4), 169–189.

Davidson, C. N., & Goldberg, D. T. (2009). *The future of learning institutions in a digital age*. Cambridge, MA: MIT Press.

Dempsey, J. V., & Van Eck, R. N. (2002). Instructional design on-line: Evolving expectations. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design and technology* (pp. 281–294). Upper Saddle River, NJ: Merrill Prentice-Hall.

Dewey, J. (1933). *How we think* (rev ed.). Boston, MA: D. C. Heath.

Dewey, J. (1938). *Experience and education*. New York, NY: Macmillan.

Durkheim, E. (1933). *The division of labor in society*. New York, NY: Free Press of Glencoe.

Entwistle, N. J. (2000). Approaches to studying and levels of understanding: The influences of teaching and assessment. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (pp. 156–218). New York, NY: Agathon Press.

Entwistle, N., & Tait, H. (1990). Approaches to learning, evaluations of teaching, and preferences for contrasting academic environments. *Higher Education, 19*, 169–194.

Fahy, P. J., Crawford, G., & Ally, M. (2001). Patterns of interaction in a computer conference transcript. *International Review of Research in Open and Distance Learning, 2*(1). Retrieved September 20, 2006 from http://www.irrodl.org/index.php/irrodl/article/view/36/73.

Garrison, D. R. (2007). Online community of inquiry review: Social, cognitive, and teaching presence issues. *Journal of Asynchronous Learning Networks, 11*(1), 61–72.

Garrison, D. R. (2009). Roles of authentic activities for online learning. In *2009 Conference on distance teaching & learning, Madison, WI*.

Garrison, D. R., & Akyol, A. (2009). The role of instructional technology in the transformation of higher education. *Journal of Computing in Higher Education, 21*, 19–30.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*, 87–105.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence and computer conferencing in distance education. *The American Journal of Distance Education, 15*(1), 7–23.

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. *The Internet and Higher Education, 10*(3), 157–172.

Garrison, D. R., & Cleveland-Innes, M. (2005). Facilitating cognitive presence in online learning: Interaction is not enough. *The American Journal of Distance Education, 19*(3), 133–148.
Garrison, D. R., Cleveland-Innes, M., & Fung, T. (2004). Student role adjustment in online communities of inquiry: Model and instrument validation. *Journal of Asynchronous Learning Networks, 8*(2). Retrieved September 1, 2004 from http://www.aln.org/publications/jaln/v8n2/v8n2_garrison.asp.
Garrison, D. R., Cleveland-Innes, M., & Fung, T. S. (2010). Exploring relationships among teaching, cognitive and social presence: Student perceptions of the community of inquiry framework. *The Internet and Higher Education, 13*(1–2), 31–36.
Gorsky, P., & Caspi, A. (2005). Dialogue: A theoretical framework for distance education instructional systems. *British Journal of Educational Technology, 36*, 137–144.
Greivenkamp, D., Stoll, C., & Johnston, H. (2009, April 21). *Demystifying invisible processes using mediated feedback.* In Paper presented at the 2009 teaching and learning with technology conference. Retrieved July 25, 2009 from http://www.itap.purdue.edu/tlt/conference/presentation.cfm?propid=133.
Gunawardena, C. N. (1995). Social presence theory and implications for interaction and collaborative learning in computer teleconferences. *International Journal of Educational Telecommunications, 1*(2/3), 147–166.
Gunawardena, C. N., Carabajal, K., & Lowe, C. (2001, November). Multi-faceted evaluation of online learning environments. In *Roundtable discussion at the Association for Educational Communications and Technology (AECT) 2001 international conference, Atlanta, GA*.
Gunawardena, C. N., & Zittle, F. J. (1997). Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. *The American Journal of Distance Education, 11*(3), 8–26.
Hativa, N., & Marincovich, M. (Eds.). (1995). *New directions for teaching and learning—Disciplinary differences in teaching and learning: Implications for practice*. San Francisco, CA: Jossey-Bass.
Hirumi, A. (2002). Interactivity in distance education: Current perspectives on facilitating e-learning. *Quarterly Review of Distance Education, 3*(2), v–viii.
Hirumi, A. (2006). Hirumi, Analyzing and designing e-learning interactions, C. Juwah, Editor, *Interactions in online education implications for theory & practice*, Routledge Publishing, New York (2006), pp. 46–71.
Helmi, D. G., Haynes, G., & Maun, C. (2000). Internet teaching methods across the disciplines. *Journal of Applied Business Research, 16*(4), 1–12.
Hiltz, S. R., & Wellman, B. (1997). Asynchronous learning networks as a virtual classroom. *Communications of the ACM, 40*(9), 44–49.
Hornik, S., Sanders, C. S., Li, Y., Moskal, P. D., & Dziuban, C. D. (2008). The impact of paradigm development and course level on performance in technology-mediated learning environments. *Informing Science, 11*, 35–57.
Hratsinski, S. (2008). What is online learner participation? A literature review. *Computers in Education, 51*, 1755–1765.
Ice, P. (2008, April). *The impact of asynchronous audio feedback on teaching, social and cognitive presence.* In Paper presented at the first international conference of the Canadian Network for Innovation in Education, Banff, AB.
Ice, P. (2009a). Using the community of inquiry framework survey for multi-level institutional evaluation and continuous quality improvement. *Sloan-C Effective Practices.* Retrieved August 30, 2009 from http://www.sloan-c.org/node/1931.
Ice, P. (2009b). Using online collaborative document editors to enhance student satisfaction and cognitive presence outcomes. *Sloan-C Effective Practices*. Retrieved March 10, 2010 from http://www.sloan-c.org/node/1243.
Ice, P. (2010). The future of learning technologies: Transformational developments. In M. F. Cleveland-Innes & D. R. Garrison (Eds.), *An introduction to distance education: Understanding teaching and learning in a new era* (pp. 137–164). New York, NY: Routledge.
Ice, P., Curtis, R., Philips, P., & Wells, J. (2007). Using asynchronous audio feedback to enhance teaching presence and students' sense of community. *Journal of Asynchronous Learning*

Networks, 11(2). Retrieved May 6, 2010 from http://www.sloan-c.org/publications/JALN/v11n2/v11n2_ice.asp.

Ice, P., Swan, K., Diaz, S., Kupczynski, L., & Swan-Dagen, A. (2010). An analysis of students' perceptions of the value and efficacy of instructors' auditory and text-based feedback modalities across multiple conceptual levels. *Journal of Educational Computing Research, 43*(1), 113–134.

Jiang, M., & Ting, E. (2000). A study of factors influencing students' perceived learning in a web-based course environment. *International Journal of Educational Telecommunications, 6*(4), 317–338.

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher, 38*(5), 365–379.

Kanuka, H., & Anderson, T. (1998). Online social interchange, discord, and knowledge construction. *Journal of Distance Education, 13*(1), 57–75.

Ke, F. (2010). Examining online teaching, cognitive, and social presence for adult students. *Computers & Education.* doi:10.1016/j.compedu.2010.03.013.

Kim, A. (2000). *Building community on the Web: Secret strategies for successful online communities*. Berkeley, CA: Peachpit Press.

Kuhn, T. S. (1970). *The structure of scientific revolutions* (2nd ed.). Chicago, IL: University of Chicago Press.

Kupczynski, L., Davis, R., Ice, P., & Callejo, D. (2008). Assessing the impact of instructional design and organization on student achievement and organization in online courses. *International Journal of Instructional Design and Distance Learning, 5*(1), 3–16.

Laird, T. F. N., Shoup, R., Kuh, G. D., & Schwartz, M. J. (2008). The effects of discipline on deep approaches to student learning and college outcomes. *Research in Higher Education, 49*, 469–494.

Langer, J. A. (1990). The process of understanding: Reading for literary and informative purposes. *Research in the Teaching of English, 24*(3), 229–246.

LaPointe, D. K., & Gunawardena, C. N. (2004). Developing, testing, and refining a model to understand the relationship between peer interaction and learning outcomes in computer-mediated conferencing. *Distance Education, 25*(1), 83–106.

Lattuca, L. R., & Stark, J. S. (1994). Will disciplinary perspectives impede curricular reform? *Journal of Higher Education, 65*, 401–426.

Lauzon, A. (1992). Integrating computer instruction with computer conferencing: An evaluation of a model for designing online education. *The American Journal of Distance Education, 6*(2), 32–46.

Lipman, M. (1991). *Thinking in education*. Cambridge, MA: Cambridge University Press.

Liu, S., Gomez, J., & Yen, C. (2009). Community college online course retention and final grade: Predictability of social presence. *Journal of Interactive Online Learning, 8*(2), 165–182.

Lohdahl, J. B., & Gordon, G. (1972). The structure of scientific fields and the functioning of university graduate departments. *American Sociological Review, 37*, 57–72.

Luebeck, J. L., & Bice, L. R. (2005). Online discussion as a mechanism of conceptual change among mathematics and science teachers. *Journal of Distance Education, 20*(2), 21–39.

Mays, T. (2006). Theoretical perspectives on interactivity in e-learning. In C. Juwah (Ed.), *Interactions in online education* (pp. 9–26). New York, NY: Routledge.

McMillan, D. W., & Chavis, D. M. (1986). Sense of community: A definition and theory. *Journal of Community Psychology, 14*(1), 6–23.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Washington, DC: US Department of Education, Office of Planning, Evaluation, and Policy Development.

Merrill, M. D. (2001). Components of instruction toward a theoretical tool of instructional design. *Instructional Science, 29*, 291–310.

Meyer, K. A. (2003). Face-to-face versus threaded discussions: The role of time and higher-order thinking. *Journal of Asynchronous Learning Networks, 7*(3), 55–65.

Meyer, K. A. (2004). Evaluating online discussions: Four different frames of analysis. *Journal of Asynchronous Learning Networks, 8*(2), 101–114.
Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*, 1017–1054.
Moisey, S., Neu, C., & Cleveland-Innes, M. (2008). Community building and computer-mediated conferencing. *Canadian Journal of Distance Education, 22*(2), 15–42.
Molinari, D. L. (2004). The role of social comments in problem-solving groups in an online class. *The American Journal of Distance Education, 18*(2), 89–101.
Moore, M. (1989). Three types of interaction. *The American Journal of Distance Education, 3*(2), 1–6.
Moore, M., & Kearsley, G. (2004). *Distance education: A systems view*. Belmont, CA: Wadsworth Publishing Company.
Muirhead, B. (2001). Interactivity research studies. *Educational Technology & Society, 4*(3), 108–112. Retrieved January 20, 2005 from http://ifets.ieee.org/periodical/vol_3_2001/muirhead.html.
Murphy, E. (2004). Identifying and measuring ill-structured problem formulation and resolution in online asynchronous discussions. *Canadian Journal of Learning and Technology, 30*(1), 5–20.
Nagel, L., & Kotze, T. G. (2010). Supersizing e-learning: What a CoI survey reveals about teaching presence in a large online class. *The Internet and Higher Education, 13*(1–2), 45–51.
Neumann, R. (2001). Disciplinary differences and university teaching. *Studies in Higher Education, 26*, 135–146.
Neumann, R. (2003). A disciplinary perspective on university teaching and learning. *Access and Exclusion, 2*, 217–245.
Neumann, R., Parry, S., & Becher, T. (2002). Teaching and learning in their disciplinary contexts: A conceptual analysis. *Studies in Higher Education, 27*, 405–417.
NSSE. (2009). *National survey of student engagement: 2008 results*. Bloomington, IN: Indiana University Center for Postsecondary Research.
Nussbaum, E. M. (2008). Collaborative discourse, argumentation, and learning: Preface and literature review. *Contemporary Educational Psychology, 33*(3), 345–359.
Paloff, R. M., & Pratt, K. (1999). *Building learning communities in cyberspace*. San Francisco, CA: Jossey-Bass.
Pena-Shaff, J., & Nicholls, C. (2004). Analyzing student interactions and meaning construction in Computer Bulletin Board (BBS) discussions. *Computers in Education, 42*, 243–265.
Phillips, P., Wells, J., Ice, P., Curtis, R., & Kennedy, R. (2007). A case study of the relationship between socio-epistemological teaching orientation and instructor perceptions of pedagogy in online environments. *Electronic Journal for the Integration of Technology in Teacher Education, 6*, 3–27.
Picard, R. W. (1997). *Affective computing*. Cambridge, MA: MIT Press.
Picciano, A. G. (2002). Beyond student perceptions: Issues of interaction, presence and performance in an online course. *Journal of Asynchronous Learning Networks, 6*(1), 21–40.
Powell, K., & Ice, P. (2010, January). *Using the community of inquiry framework for faculty assessment and improvement of online courses*. In Paper presented at the 8th annual Hawaii international conference on education, Honolulu, HI.
Rice, R. E. (1992). Contexts of research in organizational computer-mediated communication. In M. Lea (Ed.), *Contexts of computer-mediated communication*. New York, NY: Harvester Wheatsheaf.
Richardson, J. C., & Swan, K. (2003). Examining social presence in online courses in relation to students' perceived learning and satisfaction. *Journal of Asynchronous Learning Networks, 7*(1). Retrieved June 1, 2004 from http://www.aln.org/publications/jaln/v7n1/index.asp.
Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (2001). Methodological issues in the content analysis of computer conference transcripts. *International Journal of Artificial Intelligence in Education, 12*(1), 8–22.
Rourke, L., & Kanuka, H. (2007). Barriers to online critical discourse. *Computer-Supported Collaborative Learning, 2*, 105–126.

Rovai, A. P. (2002). Development of an instrument to measure classroom community. *The Internet and Higher Education, 5*, 197–211.

Saettler, P. (1990). *The evolution of American educational technology* (2nd ed.). Greenwich, CT: Information Age Publishing. (Reprinted in 2004).

Shea, P. J. (2006). A study of students' sense of learning community in online learning environments. *Journal of Asynchronous Learning Networks, 10*(1). Retrieved June 15, 2006 from http://www.sloan-c.org/publications/jaln/v10n1/v10n1_4shea_member.asp.

Shea, P., & Bidjerano, T. (2008). Measures of quality in online education: An investigation of the community of inquiry model and the next generation. *Journal of Educational Computing Research, 39*, 339–361.

Shea, P., & Bidjerano, T. (2009). Community of inquiry as a theoretical framework to foster "epistemic engagement" and "cognitive presence" in online education. *Computers in Education, 52*, 543–553.

Shea, P., & Bidjerano, T. (2010). Learning presence: Towards a theory of self-efficacy, self-regulation, and the development of communities of inquiry in online and blended learning environments. *Computers in Education, 55*, 1721–1731.

Shea, P. J., Fredericksen, E. E., Pickett, A. M., & Pelz, W. E. (2003). A preliminary investigation of "teaching presence" in the SUNY learning network. In J. Bourne & J. C. Moore (Eds.), *Elements of quality online education: Into the mainstream* (pp. 279–312). Needham, MA: Sloan-C.

Shea, P., Hayes, S., Vickers, J., Gozza-Cohen, M., Uzuner, S., Mehta, R., Valchova, A., & Rangan, P. (2010). A re-examination of the community of inquiry framework: Social network and content analysis. *The Internet and Higher Education, 13*(1–2), 10–21.

Shea, P., Li, C. S., Swan, K., & Pickett, A. (2005). Developing learning community in online asynchronous college courses: The role of teaching presence. *Journal of Asynchronous Learning Networks, 9*(4), 59–82. Retrieved May 1, 2008 from http://www.sloan-c.org/publications/jaln/v9n4/v9n4_shea.asp.

Shea, P. J., Pickett, A. M., & Pelz, W. E. (2004). Enhancing student satisfaction through faculty development: The importance of teaching presence. In J. Bourne & J. C. Moore (Eds.), *Elements of quality online education: Into the mainstream* (Vol. 5, pp. 39–59). Needham, MA: Sloan-C.

Sherry, A. C., Fulford, C. P., & Zhang, S. (1998). Assessing distance learners' satisfaction with instruction: A quantitative and a qualitative measure. *The American Journal of Distance Education, 12*(3), 4–28.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunication*. London, UK: Wiley.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1–22.

Shulman, L. S. (2005). Signature pedagogies in the professions. *Daedalus, 134*(3), 52–59.

Smeby, J.-C. (1996). Disciplinary differences in university teaching. *Studies in Higher Education, 21*(1), 69–79.

Smith, G. G., Heindel, A. J., & Torres-Ayala, A. T. (2008). E-learning commodity or community: Disciplinary differences between online courses. *The Internet and Higher Education, 11*, 152–159.

Sonwalkar, N., Flores, J. G., & Gardner, M. (2010). *Designing for quality and measuring quality in online learning: Where are we today and where do we need to go?* Boston, MA: United States Distance Learning Association.

Staley, J., & Ice, P. (2009, August). *Instructional design project management 2.0: A model of development and practice.* In Paper presented at the 25th annual conference on distance teaching and learning, Madison, WI.

Stark, J. S. (1998). Classifying professional education programs. *Journal of Higher Education, 69*, 353–383.

Stein, D. S., Wanstreet, C. E., Calvin, J., Overtoom, C., & Wheaton, J. E. (2005). Bridging the transactional distance gap in online learning environments. *The American Journal of Distance Education, 19*(2), 105–118.

Swan, K. (2002). Building learning communities in online courses: The importance of interaction. *Education Communication and Information, 2*(1), 23–49.
Swan, K. (2003). Learning effectiveness: What the research tells us. In J. Bourne & J. C. Moore (Eds.), *Elements of quality online education: Practice and direction* (pp. 13–45). Needham, MA: Sloan-C.
Swan, K., Shea, P., Fredericksen, E., Pickett, A., Pelz, W., & Maher, G. (2000). Building knowledge building communities: Consistency, contact and communication in the virtual classroom. *Journal of Educational Computing Research, 23*(4), 389–413.
Swan, K., & Shih, L.-F. (2005). On the nature and development of social presence in online course discussions. *Journal of Asynchronous Learning Networks, 9*(3), 115–136.
Thompson, J. D., Hawkes, R. W., & Avery, R. W. (1969). Truth strategies and university organization. *Educational Administration Quarterly, 5*(2), 4–25.
Thompson, T. L., & MacDonald, C. J. (2005). Community building, emergent design and expecting the unexpected: Creating a quality eLearning experience. *The Internet and Higher Education, 8*, 233–249.
Traphagan, T. W., Chiang, Y.-H. V., Chang, H. M., Wattanawaha, B., Lee, H., Mayrath, M. C., Woo, J., Yoon, H.-J., Jee, M. J., & Resta, P. E. (2010). Cognitive, social, and teaching presence in a virtual world and a text chat. *Computers in Education, 55*, 923–936.
Tu, C. H. (2000). On-line learning migration: From social learning theory to social presence theory in CMC environment. *Journal of Network and Computer Applications, 23*(1), 27–37.
Tu, C.-H., & McIsaac, M. (2002). The relationship of social presence and interaction in online classes. *The American Journal of Distance Education, 16*(3), 131–150.
Vaughan, N., & Garrison, D. R. (2006). How blended learning can support a faculty development community of inquiry. *Journal of Asynchronous Learning Networks, 10*(4), 139–152.
Vygotsky, L. (1978). *Mind in society*. London, UK: Harvard University Press.
Wallace, R. M. (2003). Online learning in higher education: A review of research on interactions among teachers and students. *Education, Communication and Information, 3*(2), 241–280.
Walther, J. B. (1992). Interpersonal effects in computer mediated interaction: A relational perspective. *Communication Research, 19*(1), 52–90.
Willment, J., & Cleveland-Innes, M. (2002, May). *Towards an emerging transactional model of facilitation for on-line teaching and learning in higher education*. In Workshop at the International Council for Open and Distance Education/Canadian Association for Distance Education Conference, Calgary, AB.
Wood, R. (2003). *Connecting for success: Effective strategies for building online community in the Cyber-classroom*. Retrieved August 10, 2010 from http://www.ipfw.edu/as/tohe/2001/Papers/ebersole/.
Wu, D., & Hiltz, S. R. (2004). Predicting learning from asynchronous online discussions. *Journal of Asynchronous Learning. 8*(2), 139–52.
York, C., Yang, D., & Dark, M. (2007). Transitioning from face-to-face to online instruction: How to increase presence and cognitive/social interaction in an online information security risk assessment class. *International Journal of Information and Communication Technology, 3*(2), 42–52.

Creating a Culture of Digital Collaborative in Online Learning

MaryFriend Shepard

Creating a Culture of Digital Collaborative in Online Learning

Learners in the twenty-first century are engaged in personal learning networks (PLNs) inside and outside of the classroom walls, often in spite of the involvement of instructors. A disconnect exists between how they use technology outside of school and how they are being educated in most schools. Learners embrace the connections they make with their peers and with strangers through technology and ask to use these connections for learning. Technology is an integral and ubiquitous part of their lives where they engage in exchanges with their peers through technological means creating meaningful social and learning experiences (Rogers and Price 2007). If students have questions, they instantly pull out their smart phones to find answers. Having instant access to information creates a different milieu and increased expectations for learning. Students in K12 and university environments are able to take charge of their own learning in ways not possible before the evolution of learning to an "anytime anywhere" approach to living and learning. Technology enables learners to access knowledge beyond the scope of instructors or textbooks.

The paradigm shift is happening with a grass roots movement beginning with learners. Students are demanding that their educational experiences be reformed to include more meaningful, authentic experiences. Speak Up 2009 found that students were desirous of three overall changes in their educational environment: "social-based learning, un-tethered learning, and digitally-rich learning" (Project Tomorrow 2010, p. 1). Technology is a means to education, not the end. Students want to use technological means to access PLNs to gain access to experts on the problems and issues they are addressing. Students do not use technology as toys

M. Shepard, Ph.D, M.A, B.A. (✉)
Walden University, Minneapolis, MN, USA

902 E. Washington Street, Thomasville, GA 31792, USA
e-mail: maryfriend.shepard@waldenu.edu

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for play exclusively; they use technology to accomplish their goals. Untethered learning requires that students go beyond the boundaries of their classroom resources, whether face-to-face (F2F) or bounded by a Course Management System (CMS) to access resources. In a digitally rich learning environment, students want more than engagement with technology; they want the technology to drive "learning productivity." These are challenges that the latest wave of distributed learning can meet, perhaps more easily than F2F learning environments.

Distributed learning is evolving with advanced technological resources making the new paradigm of learning at a distance more engaging than any time before in history. Initially, distance education was a place where instructors transferred their F2F courses online and called it online education. They often used technology to replicate digitally what teachers and students were already doing in a F2F class. When researchers explored the differences between F2F and online instruction, it was not surprising that the results indicated "no significant differences." In time, online instruction became a business enterprise, and courses were developed using a CMS like Blackboard or eCollege that improved the opportunities for learning. Threaded discussions and chat, grade books and Dropboxes, and media and online resources were all available with "one stop shopping" for learners. This safe environment allowed instructors to control the media and resources used by students in their courses, while participating in a fully online experience.

With the ubiquitous influx of technology in the lives of learners and their engagement in PLNs, the demand to go outside the walls of the CMS caused a new wave of distributed education and yet another paradigm shift in the delivery of learning experiences. While many universities still maintain a CMS as the basic structure of their online courses, students are using digital resources to maximize their learning and challenging the way they demonstrate learning. Engagement through collaboration is more powerful as students create their own wikis and blogs to share their contributions to their own growth. Learners are creating podcasts, videos, interactive presentations, and mind maps to demonstrate learning.

Instructors are adjusting to the idea that student work products are available online for critique by the public as students post their work on YouTube or AuthorStream before embedding in into their wikis and blogs. The opportunities for individual online collaboration in constructing new knowledge are powerful. As universities embrace these changes, and faculty accept the power of collaborative learning, one must wonder what the next generation of distributed education will be and how a culture of collaboration can be created and embraced.

> Teachers tell us that as a result of using technology in the classroom students are more motivated to learn (51 percent), apply their knowledge to practical problems (30 percent) and take ownership of their learning (23 percent). Teachers also report that by using technology students are developing key 21st century skills including creativity (39 percent), collaboration (30 percent) and skills in problem-solving and critical thinking (27 percent); thus, effectively preparing them for future success in the workplace and the global society. (Project Tomorrow 2010, p. 2).

As the paradigm shifts to more engaging and collaborative uses of online learning, research findings are demonstrating the benefits of distributed learning over more traditional forms of delivery.

Collaboration Versus Cooperation

Fourteen members of my family were sharing around the Christmas dinner table hours after the meal had ended when my niece asked me to explain an online course I was developing. As a part of the description, I mentioned that our students were engaged in online collaborative problem-solving activities where they were exploring the issues around a particular emerging technology. My niece interrupted and stated that they did that kind of activity *all the time* in her F2F masters program and that she *hated* group work. I asked her to describe how she and her "team members" had collaborated for the project they had just completed. She shared that they met during the first month of the course at a local coffee shop to divide the tasks among the group members. Then members completed their part of the task independently, and they met a couple of days before the project was due to put it into one document and turn it into the instructor for review.

This activity was like putting a puzzle together where each member had one piece to contribute to the whole. When everyone added their puzzle piece into the framework, the puzzle was completed. Each person benefited from this activity to the extent of their contribution to their part of the activity; they understood one part as it related to the whole. This approach met the requirements of many definitions of collaboration that stress "the act of working together to meet a goal."

This learning group cooperated to complete a task, but they did not collaborate. For present and future generations of distributive learning, a definition like this is limited, inadequate, and incomplete. Collaboration has become an overused term in distance education for activities involving two or more people who work together to meet a predetermined outcome. With the evolution of technological support for online group work, learners have the tools to engage in collaborative efforts digitally often with greater ease than in a F2F classroom. Digital tools eliminate the constraints of place and time for learners.

Collaborative learning should be a team-based approach to learner-centered engagement based on the construction of knowledge around authentic problems. Collaboration should result in a process where the final product developed by the team is greater than the product any one member of the group could have created working individually. This process requires a rethinking of education and what it means to engage collaboratively. How can learners connect using technology so the products they create and the learning that takes place are greater than an individual could accomplish alone? How do individuals maintain their individuality through an experience, so they believe their contributions to the effort are worthwhile? These are some of the challenges of the next generation of distributed learning.

Cooperative learning as conceived by Johnson and Johnson (1999) was a teacher-structured experience where students worked together with preassigned roles to accomplish a group task. Student success depended on each of the members of the cooperative group accomplishing their part of the task; the success of each student was dependent on the other members of the group. Cooperative learning was a teacher-centric activity where the teacher determined the outcomes, assigned student roles, and often developed the procedures followed by each group. In contrast, collaborative learning is a student-structured experience where learners examine an assigned task to determine how the team will approach the assignment. Roles are determined by the group, providing flexible autonomy for the collaborative team. In many cases, learners self-monitor the contributions of each team member to ensure quality. The instructor is brought into the process as a facilitator as needed.

Theory

Connectivism (Siemens 2006) assumed that learning occurs best when people create connections with the information they are exploring, as well as with other learners by establishing learning networks. The more expansive the network is, the greater the opportunity for powerful learning to take place. Vygotsky (1934/1978) believed that social learning stimulated learners to think at higher cognitive levels resulting in more efficient learning. He assumed that people learn best when they interacted with others for the purpose of completing a learning event. The key to both of these theories is social interaction. Collaborative learning requires an exchange of ideas and is an iterative process where ideas develop and change through the interactions.

Siemens's metaphor of the creation of knowledge as a river rather than a reservoir provides a foundation for collaborative engagement in the learning process. Reservoirs are much like the puzzle my niece's group cooperated to put together, where the end product was a static production based on the collection of ideas, rather than on the evolution of ideas through an iterative process. Ideas flow and continue to change as fresh thoughts energize and merge with those of others. A collaborative project in a course may have a final product that is turned in for assessment. Because it may be posted online where it can be perused by others as well as by the original members of the team developing it, authentic project may continue to evolve even after the work is completed for a particular course. "Certain types of knowledge may still pool (much like types of knowledge are hardened through expert validation and public consensus). With ongoing development of technology, cross-industry collaboration, global connectedness and competitiveness, more and more knowledge moves with river-like properties" (Siemens 2004, p. 53).

Online collaboration may be easier to achieve for individuals who have created a digital identity through PLNs. The digital socialization of individuals informally taking place outside of the learning environment opens learners to work together in academic pursuits. Siemens noted that because of the exposure individuals have with their online identities, they are open to "co-create and experience the two-way flow models of knowledge sharing and dissemination" (p. 71). Learners want to be a part of a larger group, to connect with others. Yet, learners want to maintain their own identity throughout the process, to maintain their individuality. "We do not want to fade and cease to exist as we meld with the crowd. Our tools are about individualization and personalization, but we individualize so we are a (unique) part of the crowd" (p. 105).

Personal Learning Networks

Dewey (1916) indicated that one of the single most important components in the process of education is interaction. He saw the power of social interaction as transformative in the learning process, particularly as students took static information, created new knowledge, and applied it to their personal goals and values. During the period distance education was initially being integrated into schools, Bates (1991) suggested that one of the key criteria for selecting media was its usefulness for interactivity among students. What was true in 1991 is still true today.

Students working at a distance yearn for connections with other learners, their faculty, and experts in the field. They seek to make connections through social networks as Facebook, blogs, and wikis. Media allows people to strengthen their interpersonal connections across time zones and around the globe. PLNs are a central part of the interactions of many learners, and they desire that similar networks be used for education. As students tag their blogs with the names of experts they are using in their posts, often, they receive responses back from the people they are studying. This helps learners become a part of a larger educational community.

Siemens (2006) described how learners leave a bit of themselves in multiple places on the web, creating a personal profile that is accessible to many, resulting in a unique view of the individual. "A culture of openness, recognized value of cooperation, and tools and time allotted for collaboration, all contribute to accelerate network formation" (p. 85). Siemens suggested that as people find themselves as individuals with voices on the web, their capacity to work with others, to socialize, and to collaborate increases because they can make connections based on common interests rather than being restricted to those students who happen to be registered for the same class at the same time. The power of the web for the co-creation of knowledge is enhanced, as learners expand their roles beyond only being a consumer of knowledge. Having one's ideas accessible on the web for others to explore and critique provides opportunities never before experienced to this extent in education. Institutions of higher education need to take advantage of these opportunities in distributed learning.

PLNs help individuals make sense of the massive amounts of information bombarding them through distributed media. Learners can choose to join networks that reinforce their current beliefs, or that force them to consider divergent views, or both. The conversations that take place in learning communities online often become reality as sense-making takes place among people who share common interests. Because each person has a unique PLN, the process of creating knowledge can be transformative. "In creating knowledge, we experience life, identity, hope. To contribute to the public space, to be recognized, to be a part of something bigger—these motivations drive us" (Siemens 2006, p. 106). Having one's ideas and writings exposed for public critique will transform an individual and should be a part of the educational experience. Research is needed to discover if those individuals who have strong PLNs successfully engage in online collaboration better than their peers that do not have strong PLNs.

Successful Collaboration

For collaboration to be successful in a distributed learning environment, three conditions are essential: (a) a culture of collaboration, (b) team membership skills, and (c) a place to collaborate using collaborative technology.

Culture of Collaboration. Educators can learn from their counterparts in the business world about the goals and strategies to create a culture of collaboration. In the business world, successful collaboration can be turned into dollars. In the education world, successful collaboration can be turned into learning. To expect collaboration in the workplace or in an educational setting requires a paradigm shift from traditional approaches to business or to education. A shift is required from "me" thinking to "we" thinking (Rosen 2008). Rosen indicated that the reason most collaborative efforts fail is not because of the lack of collaborative technologies but rather because a culture of collaboration has not been established. Three related attitudinal shifts were identified by Rosen that apply to online learning. Learners must shift to a mentality of "sharing over hoarding," "trust over fear," and "community over individual accomplishments."

Educators have traditionally been rewarded for the individual contributions they make to a team effort. The people who were perceived as making the most insightful contributions to a project were given promotions or high grades. Failure to share ideas was often based on the fear that another person might steal or take credit for the ideas presented. Two practices that diminish a culture of collaboration because each rewards the best ideas of individuals rather than group effort are bell curve assessment and merit pay. For collaboration to succeed, the assessment process should reward the group process and product for accomplishing the task, so that all members of the team will be motivated to share and participate. Ellett (2010) suggested that building respect and trust for divergent ideas among team members would result in the development of positive collaborative interactions.

Team Membership Skills. Participating successfully as a member of a team includes many skills. Ellett (2010) identified five key skills that businesses needed to develop in its workers to create a culture of collaboration: (a) alignment of expectations, (b) role accountability, (c) shared language and information, (d) interaction skills, and (e) consistency of interaction. Although Ellett was writing for the business world, these skills are relevant to distributed learning, particularly where a global diversity of cultures may exist among the students. If students in a collaborative group are missing some of these skills, then strategies for developing these skills need to be built into the expectations for the course, with groups demonstrating these skills being rewarded.

Ellett's model (2010) is useful in exploring team membership in distributed learning. Through initial discussions, team members need to *align their expectations* for the goals and roles they will meet during the project. If members are unable to come to agreement about the manner in which they will approach the task at hand or the roles of individual team members, then assistance should be sought from the instructor. *Role accountability* means that the team communicated about the strengths and limitations of its members to insure that the members have the ability to accomplish the task for which they are responsible in a timely manner.

A *shared language and information* will help to produce better communication when the definition of terms and access to information is the same for team members. Towndrow and Kannan (2004) found that students performed best and achieved their online goals when they had shared knowledge and interests at the beginning of a project. These findings pooled the two concepts of aligning expectations and sharing language and information from Ellett's model.

Perhaps the strongest barrier to successful collaboration is *interaction skills.* Learning to express ideas with a positive online voice is essential to the open exchange of ideas. Where ideas are expressed constructively and where disagreements are seen as opportunities for growth and discussion, successful collaboration can take place. If one member of the group tends to dominate or bully the other members, then the instructor needs to be brought in for an intervention. Finally, a *consistency of interactions* is required and should be determined by the team during initial collaborative discussions. All members must regularly participate in synchronous or asynchronous discussions, as well as in the critique and development of the work product. Because collaboration is an iterative process, the exchange and critique of ideas by all members of the team should be ongoing in the collaborative workspace.

Learners require and have a right to mutual respect and trust among team members. Skills of team membership should be developed at some point prior to collaborative work, or they must be spelled out specifically for team members to ensure a change of success. Research would be instructive to determine if people who engage in PLN tend to bring these five skills to the learning process over their peers who do not engage in PLNs.

Conrad and Donaldson (2004) posited four phases of engagement learners go through to be able to meet the goals of collaborative online learning. They called these phases newcomer, cooperator, collaborator, and initiator/partner. They suggested that as instructors helped students move through these phases of engagement, the learners would be empowered to take charge of their own learning in a manner where they could generate new knowledge.

Collaborative Space and Tools. In the current distributed learning model, collaboration may take place inside or outside the CMS. Within the CMS, threaded group discussions and whiteboard forums exist where limited interactions can take place. To maximize communication and connections, shared collaborative workspaces outside the CMS are available to maximize learning.

Collaborative workspaces provide a place where asynchronous or synchronous group discussions can take place so a history of conversations exists. They also show a history of the contributions of each person to the development of ideas (e.g., Wikis, LinkedIn, and Nings). If members of a team are unable to meet synchronously with other members, then they are able to read the conversation that took place and add to it. Another function of collaborative workspaces is that they allow for shared centralized files and documents (e.g., Google Docs or Elluminate). Collaborative sites for collecting and organizing shared information (e.g., diigo or delicious) are also useful for having shared language and information. Finally, cloud computing provides web-based media that permit the collaborative creation of knowledge saved on a web site for future use (e.g., mind mapping for brainstorming or concept building).

Engaging Collaboration

Collaboration alone is not sufficient to engage an online learner; collaboration must be engaging. Not all online learning experiences are equal or accomplish the same levels of engagement and deep learning. The co-creation of knowledge requires that emergent knowledge be authentic and relevant to the lives of learners. Palloff and Pratt (2005) argued that online collaboration promotes reflective and critical thinking, inventiveness, and initiative. They asserted that deeper levels of reflection and knowledge generation occur when students are engaged intellectually in an online environment. The online learning environment encourages learners to be responsible for their own learning and to seek out connections among the resources they encounter.

In a 10-year study, the National Survey of Student Engagement (NSSE) found that:

> Students learn more when they are intensely involved in their education and are asked to think about and apply what they are learning in different settings. Collaborating with others in solving problems or mastering difficult material prepares students to deal with the messy, unscripted problems they will encounter daily, both during and after college (NSSE 2008, p. 36).

This should be one of the dominant goals of distributed education. When possible, students should be given case studies to examine that provide authentic issues on related topics. Students should be engaged in problem-solving, decision-making, and issue analysis. As students write and rewrite about issues, they may be more engaged in learning. "The amount of writing was positively correlated with engagement, i.e., the more students wrote, the more they engaged in active and collaborative learning, student-faculty interaction, enriching experiences, and deep learning" (NSSE 2008, p. 22).

The NSSE identified five indicators that facilitated student engagement in the collegiate experience: "the level of academic challenge, active and collaborative learning, student-faculty interaction, enriching educational experiences, and having a supportive campus environment" (2008, p. 32). Several findings from this study provide insight into online learning related to engagement and collaboration. In a comparison between students in F2F classes and online learners, NSSE found that both freshmen and senior online students were more likely to participate in challenging intellectual activities than their F2F counterparts (p. 17). They found that online courses "stimulate[d] students' level of intellectual challenge and educational gains" (p. 12) as well as increased their cultural understanding of diverse groups (p. 17).

In speculating about their findings, the NSSE researchers wondered if online students tended to "embrace the spirit of independent, student-centered, intellectually engaging learning as captured by the deep learning measures" and if "professors who teach online courses make more intentional use of deep approaches to learning" (p. 17). These are certainly speculations that are subject to more extensive research. This may be a chicken-egg question. Are these attributes present in people who choose online learning experiences, or do they evolve as a result of the online collaborative experiences? Kuh (2008) found when students engaged in learning communities, there were positive benefits for students that came to college unprepared for the experience. This may lend credence to the idea that some of these characteristics develop as a result of the engaging collaborative activities provided by online learning environment. Chen et al. (2009) analyzed a subset of the NSSE data and found that online student are more likely than their F2F counterparts to use "deep learning approaches like higher order thinking, reflective learning, and integrative learning" (2009, p. 19) as they collaborate online.

The Walden Experience

Walden University is a for-profit, fully online university with a PhD and an EdS program in educational technology. To bring courses up to date and to provide a strong online experience for learners, a complete redesign of our educational technology courses took place over the last 2 years. Courses are designed collaboratively with a large team of people including subject matter experts, course designers, project managers, product managers, media production teams, permissions, editorial staff, and technological support, among others. Faculty are given developed courses to teach, although they can personalize the courses they teach using Doc Sharing and the Webliography, as well as having a strong presence in the course discussions and Class Café.

Online engagement and collaboration are integrated in each course to meet the standards articulated in this paper. In the EdS program, students are expected to take two courses each quarter for six quarters in a prescribed sequence. This enabled the systematic introduction of the skills required for collaboration in courses, so they grew from the first to the last quarter. We believe that this creates a culture of collaboration in which skills of engagement can evolve. While we use the eCollege CMS for courses, most of the assignments for the courses are completed using online tools outside of eCollege. Students provide links to their wikis, blogs, and other online creations for instructors to assess.

During the first quarter, students take a workshop on principles of online learning, including strategies for effective collaboration. Free online workshops are offered through the Student Success Center including one called *Communication* *and Teamwork in a Global Society.* From their first two courses, students understand that the online experience at Walden will include collaborative work. Students are introduced to the support provided to them through the Writing Center and Library to maximize their online success. During these two courses, students work independently on course assignments while community-building activities take place with the whole group. In a course taken early in the program, students build their own wiki where they post their project work for the quarter. They partner with one other student to provide feedback on the development of their coursework.

Quarter 2 provides readings and whole class discussions on online collaboration, and students are assigned to learning communities of three students. Rules for collaboration are established in each learning community based on the course readings and desires of the group, including consequences for members that do not participate. Two different approaches to collaboration take place in the two courses taken during quarter 2. In one course, each learning community creates a wiki, and each member sets up a page for the development of their course project. Since all members of the community share a wiki, collaborative feedback is encouraged on a regular basis. In the second course, students work in a learning community to post to and respond to each other's blogs and projects. In both cases, students reflect on and assess their experiences in their learning communities at the end of the quarter.

During quarters 3–5, similar activities take place with learning communities using blogs and wikis for the creation of knowledge, and an additional level of collaboration is added. In several courses, students collaboratively create mind maps or other web-based media to synthesize the concepts of a reading or activity. The product created by the learning community is assessed, and members receive grades based on three criteria: the group grade for the project, personal contributions to the project based on a review of the history page in the wiki, and the assessment of the members of the learning community of each others' participation.

Finally, during quarter 6, students collaborate on a capstone project where three members of a learning community create a project that synthesizes their program. The same three criteria are used to assess this project that was used during quarters 3–5 on smaller assignments. In their second course, students create an instructional unit independently for diverse learners. In the diversity course, there are no requirements for collaboration for two reasons. First, the collaboration in the first course is heavy and we did not want to create demands that kept students from doing well in either course. Secondly, we wanted to see if the students chose to collaborate or blog about their experiences when they are not required to do so.

This redesign has been a major paradigm shift for our university, as we encourage students to use Web 2.0 tools outside of eCollege to demonstrate their learning. We believe in "anytime anyplace" learning and try to provide the tools to make this learning seamless. Students now have access to *MyWalden,* a smart phone app that allows them to download course podcasts and videos for viewing. As learners engage in collaborative learning for the co-construction of knowledge, we are curious to see where we need to go next in the design of our online learning experience.

Questions for Consideration

Creating a culture of collaboration for successful online learning experiences provides many opportunities for further research. The following are a few questions for consideration:

1. Do learners who participate in PLNs collaborate more successfully online than their peers who do not participate in PLNs?
2. Do learners who possess Ellett's five collaborative skills achieve greater success in online collaboration than learners who do not possess these skills?
3. Are there regional differences that influence the way learners communicate with each other? Global differences?
4. Are there regional differences that influence the way learners engage in the co-construction of knowledge in an online collaborative experience? Global differences?
5. Do learners who collaborate and engage in the co-creation of knowledge perform better than their peers who do not collaborate and engage well?
6. How do online instructors establish a culture of collaboration and teamwork in online courses? What do learners perceive the benefits to be? What do learners perceive to be the drawbacks of collaboration?
7. Do collaborative teams provide social interactions that maximize critical thinking, creativity, and problem-solving?
8. What are the benefits of collaboration and engagement with learners from different cultures or regions?
9. How do instructors change as a result of engaging learners in collaborative experiences? What is the impact on self-efficacy? What is the impact on motivation? What is the relationship on beliefs about effecting positive social change?
10. How do digital projects with learners in other countries affect ethnocentric attitudes?
11. Do online students "embrace the spirit of independent, student-centered, intellectually engaging learning as captured by the deep learning measures" (NSSE 2008, p. 17) more than their peers in F2F colleges?
12. Do "professors who teach online courses make more intentional use of deep approaches to learning" as suggested by NSSE (2008, p. 17)?
13. Does collaboration positively affect learning? If so, how? If not, why not?

References

Bates, A. W. (1991). Interactivity as a criterion for media selection in distance education. *Never Too Far, 16*, 5–9.

Chen, P. D., Guidry, K. R., & Lambert, A. D. (2009). Engaging online learners: A quantitative study of postsecondary student engagement in the online learning environment. In *Paper presented at AERA*, April 13–19, San Diego, CA.

Conrad, R. M., & Donaldson, J. A. (2004). *Engaging the online learner: Activities and resources for creative instruction*. San Francisco, CA: Jossey-Bass.

Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. New York: The MacMillan Company.

Ellett, J. (2010). *Thought leadership: Building a culture of collaboration.* http://www.nfusion.com/article/thought-leadership-building-a-culture-of-collaboration.

Johnson, D. R., & Johnson, R. T. (1999). *Learning together and alone: Cooperative, competitive, and individualistic learning* (5th ed.). Merrill: Merrill Publishing Company.

Kuh, G. D. (2008). *High-impact educational practices: What they are, who has access to them, and why they matter*. Washington: Association of American Colleges and Universities.

National Survey of Student Engagement. (2008). *Promoting engagement for all students: The imperative to look within. 2008 results*. Bloomington: NSSE http://nsse.iub.edu/NSSE_2008_Results/docs/withhold/NSSE2008_Results_revised_11-14-2008.pdf.

Palloff, R. M., & Pratt, K. (2005). *Collaborating online: Learning together in community*. San Francisco: Jossey-Bass.

Project Tomorrow (2010). Learning in the 21st century: 2011 trends update. Irvine, CA: Project Tomorrow. Retrieved from http://www.tomorrow.org/speakup/learning21Report_2010_Update.html.

Rogers, Y., & Price, S. (2007). Using ubiquitous computing to extend and enhance learning experiences. In M. van't Hooft & K. Swan (Eds.), *Ubiquitous computing in education* (pp. 329–345). Mahwah: Lawrence Erlbaum Associates.

Rosen, E. (2008). *The culture of collaboration*. San Francisco: Red Ape Publishing Company.

Siemens, G. (2004). *Connectivism: A learning theory for the digital age*. Retrieved April 18, 2009, from http://www.elearnspace.org/Articles/connectivism.htm.

Siemens, G. (2006). *Knowing knowledge*. Published under a Creative Commons license.

Towndrow, P. A., & Kannan, J. (2004). The role of collaboration in the design and production of on-line English language learning materials. *Teaching and Learning, 23*(1), 77–84.

Vygotsky, L. S. (1978). Cambridge: Harvard University Press. (Original work published 1934) http://www.nfusion.com/article/thought-leadership-building-a-culture-of-collaboration.

Comparing Formal, Non-formal, and Informal Online Learning Environments

Richard A. Schwier

Introduction

In recent years, we have witnessed deep challenges to how we think about learning, learning design, and learning environments. One of the most significant challenges we face is how to understand and employ non-formal and informal learning opportunities for students. Distance learning, built initially and intentionally on formal, institutional structures, are augmented or replaced by non-formal and informal learning opportunities that users shape into personal learning environments. This chapter argues that as educational technology professionals and as instructional designers, we need to embrace the constructs of non-formal and informal learning and make them our own. We may need to support formal learning, and in fact, we may even make most of our livings from it, but we should not give our hearts over to formal learning. Much of the excitement, the potential, and the future of learning is on the non-formal/informal side of the ledger. Perhaps even more importantly, it is where the fun is hiding in our profession.

The need for and design of collaborative online learning environments have been well-documented for some time in the literature (e.g., Bernard et al. 2004; Cox and Osguthorpe 2003; Kirschner et al. 2004; Milheim 2006; Murphy and Coleman 2004; Reeves et al. 2004). But the literature is focused principally on formal learning environments (principally postsecondary courses offered in higher education). Formal environments typically require learners to engage each other online in specific, externally defined ways, whereas non-formal environments impose fewer controls on learner activities. The nearly exclusive attention to formal settings limits our understanding of how learners make use of virtual communities for self-directed learning.

R.A. Schwier, Ed.D (✉)
College of Education, University of Saskatchewan,
28 Campus Drive, Saskatoon, SK, Canada, S7N 0X1
e-mail: richard.schwier@usask.ca

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Our research program at the University of Saskatchewan has contributed to this myopia. In recent years, we devoted our attention to developing a model of virtual learning communities (VLCs) and how they operate in formal online learning environments such as postsecondary courses. That program of research focused on theoretical work that included communities of practice and social capital (Virtual Learning Communities Research Laboratory 2009). At the same time, considerable research has appeared that describes the experiences of instructors and students in formal VLCs and identifies characteristics of those communities (cf. Anderson 2003; Brook and Oliver 2006; Garrison et al. 2003; Luppicini 2007; Murphy and Coleman 2004).

As an observation about this line of research generally, the research on formal VLCs has helped shape a narrow view of how learning communities form, grow, and flourish—an unfortunate side effect given the growing importance of non-formal and informal learning to learning generally, and specifically in online social environments.

Features of Formal, Non-formal, and Informal Learning Environments

I posit that context profoundly influences the structure and nature of learning, a statement that sounds like a truism, but in fact is fundamental to understanding how people engage each other in online settings. When learners enter a university classroom, whether it is physical or virtual, a range of expectations insinuate themselves into the learning environment. For example, learners expect that someone has designed the learning environment; they assume there will be a credentialed instructor who will tell them what to do, and maybe even what to think; they anticipate assignments and examinations. When students search for answers in a public discussion board, their expectations are probably quite different. They assume responsibility for asking a clear question and for negotiating meaning with anyone who responds; they hope to find people with expertise, but they may be less certain about the credentials of the experts they encounter; when their learning goal is achieved, they are free to end their association with the group and helpers; protocols for interaction are dictated by group expectations and good manners, and less often by fear of failure or by explicit policy.

The context for learning online is a central focus of this chapter. In order to organize our ideas, we categorize learning environments as formal, non-formal, and informal. These are slippery categories, and while it is relatively easy to articulate definitions and find epitomes, the categories are less precise in practice. Any rich learning environment may exhibit features of all three, so we invite the reader to consider these as categories of convenience for this discussion rather than templates for learning environments. To shape the conversation, I will compare key features (see Table 1), offer speculations, and, where available, draw on research we have conducted, to consider how the notion of online learning communities might be expanded and interrogated in new ways.

Table 1 Comparison of key features of formal, non-formal, and informal learning environments

	Formal learning environments	Non-formal learning environments	Informal learning environments
Prescription	Prescribed and externally defined learning environment that promotes explicit learning, not casual or serendipitous learning	Prescribed but unfettered learning environment which emphasizes learning that is intentional, not casual or serendipitous	An undefined and unfettered learning environment that is permeable, responds to the inquiries of the user, and acknowledges the importance of serendipity
Membership	Closed membership, typically fees paid, members registered to gain access, identity shared with other members	Bounded membership, sometimes closed, members registered to gain access, identity shared with other members	Unbounded membership, often requires free account, pseudonym or actual name used at discretion of member and identity information selectively shared with other members
Structure	The content for learning defined institutionally; the structure for learning defined externally by an instructor who makes pedagogical decisions for the learners. Instructor directs learners and learning	A flexible structure for learning defined externally, usually by an instructor or facilitator who organizes learning events and activities and is present during the operation of group learning events	Structure developed and maintained by the learner. Learning may be serendipitous and chaotic, or it may be deliberate and highly structured, depending on the intentions of the learner
Goals	Program and instructors define goals	Learner control of the objectives of learning and the level of participation in learning activities and events; personal intentions outweigh externally defined intentions	Goals and intentions defined by the learner and are not always articulated or clear
Expectations	Organizational expectations around participation, investment, persistence, and completion	Participants, although free to determine the level of participation in particular activities, are encouraged to invest deeply in the course and follow through on personal commitments to participate. The learning path is self-directed	Expectations are intrinsic, as is the locus of control for learning
Outcomes	Performance assessed and grades assigned by the instructor. Sometimes, there are institutional expectations about comparative performance indicators (e.g., curved marks)	Internal, self-directed outcomes guide the learning path. Outcomes and achievement standards determined by participants	Peculiar to the individual and determined by the individual learner, and there is no external review of learning

Formal Learning Environments

By formal, we refer to educational contexts typically characterized by learners in classes being taught by teachers who deliver comprehensive, multiyear curricula, which are institutionally bound to a graduated system of certification (Coombs 1985). In order to understand how learners engage in formal online learning environments, we developed a conceptual model of VLCs from existing literature and later refined it (Schwier 2007). The descriptive model of formal VLCs included three interacting categories of characteristics: catalysts, emphases, and elements.

Communication is a catalyst for community, and a recent meta-analysis of key variables in online learning pointed to the significance of synchronous and asynchronous communication in facilitating learning (Bernard et al. 2004), and other studies point to the importance of good sociability being critical to the development of productive lifelong learning environments (Klamma et al. 2007). Where there is communication, community can emerge; where communication is absent, community disappears. Four factors were found to act as catalysts and orbit communication in formal VLCs: awareness, interaction, engagement, and alignment (Schwier 2007). These are the products of communication when it acts as a catalyst for community.

Formal learning environments emphasize different purposes, and we suggest these are important to understanding how a VLC operates. The model suggests five tentative emphases: ideas, relationships, reflection, ceremony, and place. Each of these purposes defines a focus for individual participation. While some communities are deliberately constructed to promote one or more of these purposes, any particular emphasis is also the result of the individual's intention for using the community.

What turns the group into a community rather than merely a collection of people with a shared interest? Some time ago, we discovered a discussion of terrestrial communities that identified six elements we also found in our own analysis of VLCs: historicity, identity, mutuality, plurality, autonomy, and participation (Selznick 1996). We added seven features to this list based on our research: trust, trajectory, technology, social protocols, reflection, intensity, and learning. The 13 elements were identified in a series of grounded theory studies of online graduate-level seminars and subjected to social network and Bayesian modeling analyses (Schwier and Daniel 2007). These elements underscore the idea that communities are a complex of many factors and variables. Any adequate understanding of VLCs needs to recognize that these variables interact multidimensionally, at least, in formal learning environments.

Non-formal Learning Environments

Selman et al. (1998) identify non-formal learning as that which "comprises all other organized, systematic educational activity which is carried out in society, whether offered by educational institutions or any other agency. It is aimed at facilitating selected types of learning on the part of particular sub-groups of the population" (p. 26). For example, non-formal education may include such activities as professional development interest groups or community education initiatives. These alternative group learning contexts are usually characterized by participants who share expertise and knowledge, and may or may not include a content expert.

Extrapolating from definitions of formal learning environments by Eraut (2000) and Livingstone (1999, 2001), non-formal environments can be characterized by:

- A prescribed but unfettered learning environment which emphasizes learning that is intentional, not casual or serendipitous.
- A structure for learning defined externally, usually by an instructor or facilitator who organizes learning events and activities and is present during the operation of group learning events.
- Learner control of the objectives of learning and the level of participation in learning activities and events; personal intentions outweigh externally defined intentions.
- Internal, self-defined outcomes guide the learning path.
- Organizational expectations around participation, investment, persistence, and completion.

Informal Learning Environments

In stark contrast to either formal or non-formal learning environments, informal education is often characterized as unorganized (not disorganized), unsystematic (not a-systematic), and regularly serendipitous (Selman et al. 1998). This type of learning can embrace the lifelong process of learning by which people acquire and accumulate knowledge, skills, attitudes, and insights gathered from a lifetime of experiences. For the purpose of this discussion, however, we will focus on learning environments that allow users to structure and control their learning, whether or not that learning is intentional or incidental. The locus of control is held firmly by the learner, as is the intention and structure of learning, and the purpose of gathering with others to learn is to capitalize on what the group may have to offer, a strategic and situation-specific approach rather than a chaotic approach, as it is so often described.

In informal learning environments, learners need to exercise a high degree of self-directedness in their approaches to their learning. Some authors have characterized the self-directed learner as learning alone, whether under the tutelage of an instructor or agency, or completely independent of such structures (Tough 1971; Selman et al. 1998). However, we would expand the notion of independence to include being independent of the structural contexts of education; any particular learner or group of learners may manifest elements of self-directedness and informality in their learning whether it be within a formal, non-formal, or informal learning environments.

In order to examine how these features play out in online learning environments, I will draw on three epitomes of formal, non-formal, and informal learning (see Table 2). Learner participation, teaching roles, the nature of learning, and research challenges will be considered in turn, and the epitomes will be used to highlight key issues. The reader should know that each epitome has been subjected to formal

Table 2 Descriptions of epitomes selected for comparison

Epitome of a formal learning context	Epitome of a non-formal learning context	Epitome of an informal learning context
An online graduate seminar offered over the span of an entire academic year	A professional development course on teaching in higher education	Online public community devoted to a broad area of general interest
Twelve graduate students and one instructor	Ten novice professors and one instructor over the course of one academic year	Dozens of participants enter the environment, post questions or observations, and invite other participants to comment
Online discussions scheduled so that each online topic in the course included one asynchronous event every week	Participation in the course was voluntary, and there were no professional incentives available to participants beyond what they believed they could learn from the course to improve their teaching performance	Participation completely voluntary; spectators access content without identification; members can contribute to conversations or start discussions using real names or pseudonyms
Instructor posted an introduction, assigned readings, and questions for a topic	An instructor developed the course, selected the content, identified the objectives, and presented material to the students	The area of interest is explicitly described in the title, graphics, merchandise, epithets, and brief descriptions
Students were required to post prescribed commentary Each student was asked to respond to at least two postings from other students	The group met once biweekly for 2 h to review each topic in turn. A syllabus, complete with due dates, topics and recommended readings, and activities was provided. Although mutable, it was the default template for the course. An instructor and a teaching assistant were present in face-to-face and online sessions to facilitate discussions	No instructor, but presumably a moderator who can ban participants who violate terms of service
All activities were completed within one calendar week	The course was deliberately designed to be non-formal and to emphasize self-directed learning	Predominantly asynchronous communication initiated by participants and at the discretion of participants
The group was predominantly made up of Western, English-speaking graduate students. All of the students exhibited facility with writing, and there was ample evidence that students were willing to engage in academic argumentation with each other and with the instructor	The instructor posted one question or challenge every other week related to the upcoming topics in the course Participants were encouraged to respond to the question and to each other before the class meetings on the topics. Participants, although free to determine the level of participation in particular activities, are encouraged to invest deeply in the course and follow through on personal commitments to participate Resources and links to additional material were provided, and participants were encouraged to also contribute resources they found to the group's collection There were no grades, marks, or formal assessments in the course. A Certificate of Participation was issued to participants	Activities and discussions open-ended; no external expiration date Characteristics of participants, such as ethnicity, unknown unless self-disclosed Learning outcomes were determined by individual participants; no external validation of learning or knowledge of what learning took place

observation, and references will be made to data, but the purpose of this chapter is not to report on formal research. These epitomes are used for illustration and to invite conversation, and outcomes may be peculiar to the contexts studied. For this discussion, the focus will be on larger conclusions and speculations about how what we have learned about how people interact and learn in different online settings, not on the specifics of how studies were conducted.

Sense of Community

One issue we initially grappled with is whether the online groups we were observing could be characterized as communities. Did participants consider their groups "communities," and did the groups exhibit patterns of communication that suggested a community might exist? There are helpful measures for this, notably the Classroom Community Scale (CCS) proposed by Rovai and Jordan (2004) and Chavis' "Sense of Community Index" adapted for use with online learning groups (Brook and Oliver 2006). These scales were useful for obtaining rough estimates, and of the groups we analyzed, formal environment revealed stronger measures of a sense of community than did the non-formal learning environment. This was not surprising, as formal groups were essentially forced to interact with each other, and over time this resulted in greater familiarity, intimacy, trust, and affiliation. Non-formal learners were not required to interact at first, so fewer did, and even fewer maintained sustained contact. This resulted in lower levels of familiarity, intimacy, and affiliation.

When we turned our attention to the informal environment, we were faced with a dilemma. We could not use the same measures because the audiences we observed were elusive—made up of anonymous members who appeared and disappeared in the learning environment, individuals we could not identify, much less sample and subject to formal scales. We were left with observational data, and while useful for other comparisons, these data did not allow us to compare these groups' relative sense of community. So we relied on other measures of interaction to get measures of interactions among participants. Fahy et al. (2001) proposed several useful measures of describing interaction that they called collectively the Transcript Analysis Tool (TAT). The TAT includes methods of measuring density, intensity, and persistence of interactions in transcripts of online discussions. We drew on their recommendations and extended some of them to analyze interactions in our data, particularly transcripts of asynchronous discussions. Conclusions drawn from these observations are included in the discussion of learner participation that follows.

Learner Participation

Learners may participate in any online learning environments for a host of reasons, responding to personal desires and external requirements or pressures. Before offering a few generalizations about audience differences in the settings we observed, it is important to acknowledge that any environment includes individuals who are pursuing their own learning agendas, and any attempt to generalize will be filled with exceptions and flaws (Daniel et al. 2007). Nevertheless, it seems reasonable to speculate that membership in formal learning communities is significantly influenced by program requirements and course designs, as often as by pure interest. If a course is required as part of a credential, learners may have a deep interest in the broader area of study, and in some cases, learners may have a focused interest in a particular course or topic. But formal, bounded learning environments may typically find learners registered for courses to satisfy externally imposed program requirements. Even if taken as electives, courses may be chosen from a limited range of choices, and selected because they are offered in a format that is attractive to the learners. In an online graduate seminar I am currently teaching, 16 of the students are required to take the course as part of their programs, and two are registered in the course as an elective because it fits their need to complete a summer course in a format that allows them to be fully employed. The challenge of building a strong sense of community in this group is therefore different than a group gathered by shared affinity.

Generally speaking, these groups will likely differ significantly from those found in non-formal and informal learning environments, where participation is based on affinity rather than requirement or fiat. Online informal learning communities usually depend on the participation of relatively autonomous, independent individuals. In some non-formal and most informal online communities, participants can engage or disengage from the group easily and without personal consequence, and they can sometimes participate in the community without revealing who they are to the other participants. Autonomy and independence present particularly difficult challenges for educators in informal settings who want to grow and maintain a learning community, because communities depend on the interdependence of their participants for their survival. "The challenge for educators is to learn how to create a system in which people can enter into relations that are determined by problems or shared ambitions, and that are not overburdened by rules or structure" (Heckscher and Donnellon 1994, p. 24).

When we compared overall participation patterns in formal, non-formal, and informal settings over time, we noted some differences (see Fig. 1). In formal environments, participation was initially high and grew over time as participants moved beyond assigned postings and added their own contributions voluntarily. In the non-formal environment we observed, participants were encouraged but not required to participate. In these cases, initial participation rates were not as high as in formal environments, as a few participants chose not to post to the discussion board. In addition, we repeatedly observed that participation fell off steeply and quickly as the course progressed. By the end of the course, there was little activity on discussion topics. In the informal environment, where participation was entirely voluntary, a completely different pattern emerged, one that can be described as effervescent. Participation rose and fell over time, apparently according to the amount of interest generated on a particular topic. Some topics drew audiences; others remained relatively quiet. But as a result, it was apparent that participation patterns were mediated by the personal interest of participants in topics, rather than by fiat (as in the formal learning environment) or by duty (as in the non-formal environment). A review

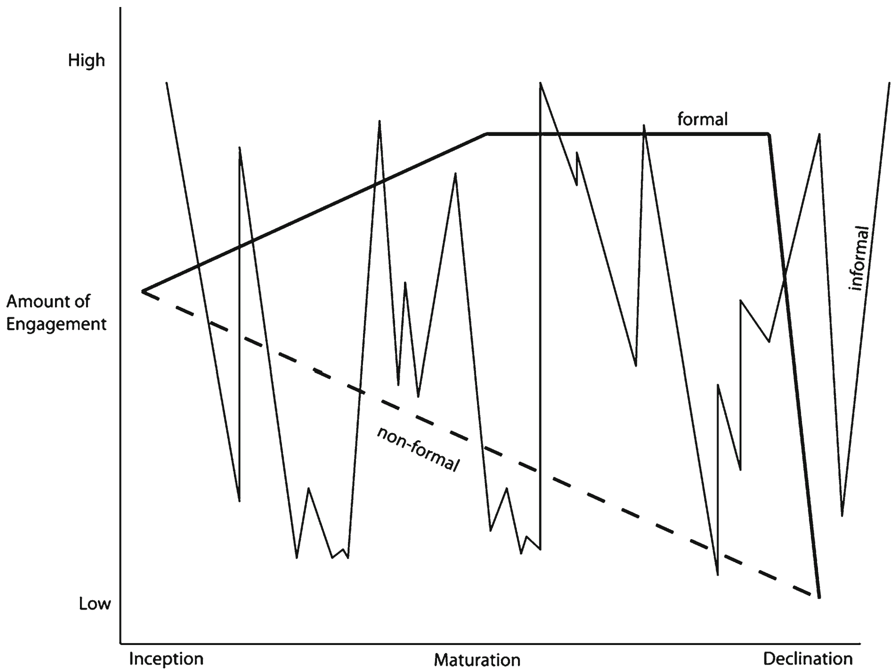

Fig. 1 Conceptual comparison of engagement patterns in learning environments over time

of the topics that drew higher rates of participation revealed that they might be provocative, humorous, profound, or personal, but in every case, they invited conversation. So in the case of our informal learning environment, participation seemed to be less about nurturing the group and more about nourishing the group—offering the audience something that drew them into a conversation. And the audience judged what was worthwhile and what was not.

In every learning environment we observed, there were bursts of engagement in online discussions where participation was high and deeply engaged. This caused our research team to coin the label "principle of intensity" to describe what we thought was at the heart of the spikes of participation we observed. We speculated that intensity might be motivated by a number of catalysts in learning environments: social advocacy, joyful learning, emotional connections to ideas, and even associations with someone who is important or provocative. But in online learning, content also seemed to be an essential ingredient for intensity that was present, regardless of the catalyst. In other words, the interactions were about something significant that was shared by the group, a feature that has been labeled "object-centered sociality" elsewhere (Zengeström 2005). When individual learning is about something meaningful to members of the group, intensity can ignite, and it can appear in both synchronous and asynchronous discussions.

Taking a closer look at the interaction patterns, we drew on Fahy et al.'s (2001) TAT indicators of intensity, density, and reciprocity. Again, because the informal environment did not have a membership that could be tracked reliably, we adjusted our methods of observation, but in every case tried to inform our understanding of the feature under investigation. Without elaborating here, we suggest that as a result we can draw some interesting speculations from our observations, but we do not make any claims about the reliability of comparisons with the informal group. We were able to employ comparative measures between formal and non-formal groups, but the unstable membership in the informal environment would not permit us to use the same assumptions when we applied the TAT measures.

Given these cautions, we found dramatic differences among the three environments. We defined intensity as the ratio of the number of postings that exceed expectations to the number of expected postings. In the formal group, this was counted as the ratio of postings that exceeded the requirements in the class; in the non-formal and the informal groups, we established a baseline expectation of one post by each participant in each discussion thread. In this case, we saw that the intensity of discussions in the formal group was considerably larger than in the non-formal group, and in fact, the non-formal group fell well below minimal expectations (formal intensity = 1.75; non-formal intensity = 0.58). The informal group, on the other hand, repeatedly demonstrated high intensity on several discussion threads, and almost no intensity on some, rendering the use of a composite ratio meaningless.

A measure of density is a ratio of the number of actual connections to the number of potential connections among participants. Density asks whether all possible connections among participants are being made; in other words, does everyone in the network connect with everyone else? We found that a greater number of people in the formal environment connected with fellow participants than in the non-formal environment (formal density = 0.78; non-formal density = 0.47), but this was at least partly an artifact of the measure of intensity. Fewer people were engaged in the first place, so fewer connected with each other. While not surprising, it is another indication that the community bonds in the non-formal group were weaker than in the formal group. Once again, the informal group was curious. Because people came and went in the group more casually, it was difficult to track density in the same way. But we did find that density was lower in informal environments. In discussion threads in the informal environment, there was clustering around the person who began the conversation, but few connections among individuals responding. Conversations were bidirectional, not multidirectional.

Reciprocity among participants is a measure of the ratio between the number of messages received by individuals to the number sent. In other words, did people realize balanced conversations in the group, which would be represented by a ratio of 1.0 if individuals received and sent the same number of messages? In this case, we found that the mean reciprocity of participants in formal and non-formal environments was high and similar (formal reciprocity = 0.96; non-formal reciprocity = 0.92). However, the mean reciprocity of the group masked considerable differences. We found that the standard deviation for the formal group was low (s.d. = 0.37), indicating that reciprocity did not vary across individuals in the formal group as much as it did for individuals in the non-formal group (s.d. = 0.94). Once again, the informal group demonstrated a considerable amount of variance, with very low reciprocity for the group, but this was expected, given the voluntary, occasional, and casual nature of interaction in this environment. Yet as a casual anecdotal observation, we noticed people were considerate of each other in the group; when somebody posted a comment, the person who posted the original topic was often attentive and responsive.

Community as a Failed Metaphor

The participation data from these three examples suggest that they were dramatically different learning contexts, and while it is not reasonable to generalize from them, it is interesting to speculate about the differences. First of all, our observations suggest that “learning community” is not a useful framework for understanding interactions in these non-formal and informal environments. Learners did not interact with each other in ways that suggested deep connection among the participants. We found few of the markers of elements of community that were extrapolated from earlier research on formal learning communities. There were few opportunities to observe engagement that was sufficiently persistent for anything we might label as community to emerge. How did non-formal and informal learning differ from the communities we have seen develop in formal contexts?

In formal communities, trust was identified by the participants as the most significant single prerequisite factor in enabling vibrant communities to emerge, whereas in non-formal environments, it was ranked much lower (Schwier 2009). It appears that without trust, there is very little likelihood that an authentic community will emerge. We concluded that if participants share high levels of trust, they are more likely to engage deeply and take learning risks. But we see that trust takes time to build, and that some individuals are more willing to trust than others, so it is an elusive quality that can be promoted, but not imposed on a learning environment. In non-formal and informal learning environments, where interaction is brief and fleeting, interpersonal trust may have little opportunity to take hold. At the same time, individuals in these environments may trust the learning they accomplish, even if they do not associate deeply with other members of the group.

Associated with trust is the idea of intimacy, and intimacy is necessary for the development of deep relationships and commitment to others and the community at large. One of the factors that can influence intimacy is the number and transparency of participants in any particular group, and this is yet another feature that was missing in the non-formal and informal environments we observed. Allen (2004) described his sense of optimal group sizes in a post on his blog, suggesting that optimal learning team sizes range between 5 and 8, with larger groups breaking down because there is not sufficient attention paid to the individual members. But in online environments, we see learners who have much larger social networks and seem to navigate them successfully. The functional size of a group seems to depend on the intentions of those involved for connecting with each other, and because informal groups are made up of fewer people who are close and intimate, yet they are connected to a wider array of people casually and intermittently.

Individual comfort in a group, and consequently the likelihood of a community growing out of online relationships, is influenced by how people treat each other. An ethic of forgiveness seems to permeate successful formal learning communities. We think this is part of building a context that encourages risk-taking and ultimately, learning. Forgiveness was apparent in discussions we observed in formal environments and was most often evidenced by individuals who expressed concern that they had offended someone by attacking an idea that had been posted. Learners often replied by reassuring the person that no offense had been suffered, and that the criticisms were valuable in some way to that person's learning. There was less evidence of this kind of treatment in non-formal and informal environments. The focus in these environments seemed to be on the content, with less attention paid to the relationships among participants. At the same time, exchanges were almost entirely friendly and courteous (probably an artifact of the group we selected to observe), so it is possible that there was no perceived need to offer forgiveness.

Another thing we have learned is that people connect in dramatically different ways to learning communities. Their participation is not uniform, for individuals over time, or for all members of the group at any particular time. We see that learners may interact a great deal, but to little effect. Some may engage deeply, but not overtly. Some may engage overtly, but not deeply. In other words, participation does not equal engagement for learners, and while interaction is visible, engagement is hidden. Hudson and Bruckman (2004) noted similarities in how people participate online with a social phenomenon called the "bystander effect." Essentially, the bystander effect posits that people are less likely to offer assistance in an emergency when they are in a group of people—that the presence of a group actively inhibits an individual from acting in an emergency. One explanation for a lack of participation is "social loafing or free riding," a phenomenon not unique to online learning communities, but one that has been repeatedly identified as a problem in the online learning literature (Piezon and Donaldson 2005). But social loafing and free riding are associated primarily with formal learning environments, where the motivation to learn and the activities directing that learning are prescribed externally. In non-formal and informal learning environments, self-directed learning is predominant, and what was labeled as free riding in formal environments can be characterized sharing in informal environments, a more positive view of a legitimate and important learning activity.

We have also learned that these learning environments have life cycles, and they are quite different in how they are expressed. There is a formative stage in the life of a group in a learning environment characterized by the attraction of new members. If encouraged to be members of a formal or non-formal learning community, participants will be deciding how significant the community will be to them, how much of themselves they will invest in it, or how they can turn it into something they can use. In the example we offer here, the non-formal group chose not to invest in the group, and consequently the opportunity for community withered quickly. In the informal community, individuals seemed to drop in and out of conversations quickly, and their participation could be better characterized as sampling rather than investing. In all, groups go through a period of testing, negotiating, and shaping, which in turn influences the investments made by participants, and determines whether the group actually turns into something more intimate and powerful than a mere cohort or scattering of strangers.

But ultimately, most online communities come to an end. In formal learning environments, the end often comes suddenly and predictably when a course ends, and this gives an unusual, and somewhat hypocritical, message to participants if we take a cynical view of formal learning environments. On the one hand, we encourage learners to come together, to discuss important matters, to learn collaboratively, and to share openly with each other. Then, at a prescribed moment, we turn out the lights, suggesting that the need for engagement and the learning that has been promoted vigorously end when the course does. In these cases, communities do not die naturally; they are assassinated. Another possibility is that the group enters a period of natural decline, a situation that is more characteristic of non-formal and informal learning environments.

Teaching Roles

A leader or leaders is essential for providing structural and support systems in any formal learning community. Teachers may act as facilitators, hosts, managers, coaches, or electronic gurus, but however named, they are essential to the success of a VLC. The leader sets the agenda and the tone for the VLC and is the person known to all of the members of the community as the touchstone for protocol and administrative issues. This teacher-centric role shifts dramatically in non-formal and informal environments. Specifically, non-formal and informal environments emphasize a shift toward self-directed learning, and as that shift occurs, an instructor or leader adopts a less directive posture in the learning environment.

This does not suggest that there is no need for a leader, but the primary role of the leader shifts from content expert to facilitator. For example, on social networking sites, the leader could be the person whom members contact for information about uploading a profile photo or commenting on blog posts. This person might also intervene if a disagreement between members is monopolizing the list and suggest that the discussants move to a private area to argue. In a healthy and well-established virtual community, members of the community handle most "policing" of the community themselves, but the judicious intervention of a community leader can be invaluable.

In non-formal and informal environments, it is also critically important that support technologies become transparent and allow participants to concentrate on the tasks, relationships and ideas at hand, and creating their own balance between content and community (Couros 2009; Schwier and Dykes 2004, 2007). An important distinction here is that in online environments, participants are not just connecting *with* technology but are also connecting *through* technology. A learning environment that emphasizes technology or makes technology a hurdle in the system is less likely to succeed, given the overhead necessary to maintain the system.

A safe and open protocol for interpersonal contact is essential to building trust in an online community of learners. Sharing and learning can promote dialogue only when there is group consensus about how members will be treated within the community. People need to feel comfortable to participate, and unless the invitation to participate is explicit, and the boundaries of acceptable behavior are shared and understood, people will not be as likely to take risks in their communication with other members of the community. It is reasonable to publish written codes of conduct to keep groups on track in formal learning environments, but it is a greater challenge to dictate standards of participation as learning environment move toward being more informal. We wonder whether this contributes to the difficulty of creating a sense of community in informal environments. Because there is not an easily identified leader who determines the boundaries of appropriate interactions, individuals may be cautious or tentative about their participation.

In order for learners to successfully exploit informal learning environments, it is also essential for educators to acknowledge that much of the learning that takes place in online environments is actually embedded in the connections among people (Siemens 2005, 2008, 2010; Wiley 2010). Without significant and unfettered communication among learners, most of the available learning will not happen. The urge to control and shape the learning environment has to give way to a stronger urge to encourage learners to explore, connect, share, and find their own learning paths. Enough structure is necessary to facilitate communication in the community, but the members of the community should not feel constrained by the structure. It is important to control the growth of an online learning community in some settings, but equally important not to control the group if an authentic community is to be allowed to develop, and for learning to be maximized.

Recently, we have witnessed the development bold open learning initiatives that provide transparent, layered learning opportunities and exhibit features of both bounded and unbounded VLCs. For example, Couros (2009) described a course he created that offered layers of participation to thin the walls of the traditional university classroom. Students could register and participate in relatively conventional ways using videoconferencing technologies, but a wider audience could observe and participate in a backchannel simultaneously, and engage with each other and with the registered participants and instructor. Similarly, and on a wider scale, George Siemens and Stephen Downes offered an online course on connectivism theory as a credit course for a small number of students, but as a non-formal learning platform for more than 2,000 students worldwide. The course featured daily updates, networks of bloggers discussing topic in the course, videoconferencing sessions, a course wiki and discussion groups using a variety of technologies such as Second Life to participate in the course. Downes coined the term MOOC, for massive open online course, to describe the intention of the course (Downes 2009). These courses, and others that will inevitably follow, not only signal important shifts in the design of learning spaces but also point to a philosophical shift from closed and bounded learning systems to open, transparent, and egalitarian beliefs about learning. Learners not only respond to their own personal epistemologies to make their own learning but also respond to shifting environmental opportunities to make their own learning environments. In this way, they are not just making meaning, but also fashioning the environments in which their learnings/meanings will continue to be recreated.

Conclusions

As a result of these observations and ponderings, and my predilection to find metaphors that work, I suggest that "community" be retired as the omnibus metaphor for groups of online learners. Our investigations are beginning to suggest that using a single metaphor for the widely differing types of engagement that happen in different learning environments is too general to be useful, and even introduces misunderstandings about the dynamic relationships in social networks and personal learning environments. As a tentative suggestion, and as an invitation for discussion, I offer three fresh metaphors for consideration.

Formal learning environments are the cattle drives of online learning environments. Learners are gathered together in herds, they are driven by cowpokes from one spot to a predetermined location, and they have no control over where that location might be. They are driven along a path, and if they wander too far from the herd, they are chased down and brought back into line. The purpose of the drive is to deliver the group on time and where they should be, and importantly, in good health. They are assessed before and after a drive to judge whether they are fit to move to the next stage. I would suggest we drop the metaphor at this point and not extend it to what happens to the herd later; learners seldom suffer that fate.

By comparison, non-formal learning environments, when offered online, evoke images of watering holes instead of cattle drives. A watering hole acts as a nurturing place, one that animals know about, where they attend to well defined needs they share with other animals. They gather and share the resources, and because each animal might have greater or lesser thirst, they exercise personal control over how much they drink. They can also engage with other animals to a greater or lesser extent, depending on what they want to accomplish (play, competition, predation). The environment is organized and offers something specific, but the uses of the environment can vary.

Informal learners, individually or in groups, are the crows of online learning, and besides, a group of crows offers a most evocative label (a murder). Crows are known to be intelligent, assertive, and adept at fashioning tools to accomplish tasks, and they can discriminate one human from another to judge whether they are safe to approach. A murder of crows, while made up of fiercely independent individuals, seems to gather together occasionally to accomplish a task, and they have a remarkable ability to organize themselves and reorganize themselves socially to accomplish different missions. They are also opportunistic; they take individual advantage of serendipitous opportunities, seemingly adjusting their intentions based on what is available in the environment. Another, less strategic yet no less evocative metaphor for informal learning environments is "intellectual estuary"—a place for different people or communities or ideas to mix without a predefined agenda (Personal Communication, D'Arcy Norman, May 6, 2010; label originally attributed to MacGillivray 2010). This is a useful metaphor, as we can envision learning as a place where a tide of content is engaged by a stream of learners.

But moving beyond metaphors, there is a more central concern of how we make sense of different contexts for learning, and maybe even take advantage of them. The question is not whether we should incorporate features of informal learning into our online spaces. Informal learning already exists and will exist, regardless of our designs or approaches. The question is how we can take what we know about learning in non-formal and informal environments and weave them into our learning designs—how can we optimize opportunities for learners to express themselves, interact meaningfully with other learners, and learn what they need. The hardest part of the design process will be getting out of the way of the learners—trusting them to assemble their own learning environments in a way that will empower them to keep reinventing their own learning solutions. And if the examples we offered here are any indication, we also need to find a new way to think about how social networking and relationships among learners can be understood and nourished. The metaphor of community, as useful as it might be for understanding how we can build formal learning environments, appears to be inadequate for capturing the dynamic, tentative, and shape-shifting nature of self-directed learning in non-formal and informal learning environments.

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References

Allen, C. (2004). *The Dunbar number as a limit to group sizes*. Retrieved from http://www.lifewithalacrity.com/2004/03/the_dunbar_numb.html. December 9, 2011.

Anderson, T. (2003). Modes of interaction in distance education: Recent developments and research questions. In M. Moore & G. Anderson (Eds.), *Handbook of distance education* (pp. 129–144). Mahwah: Erlbaum.

Bernard, R. M., Lou, Y., Abrami, P. C., Wozney, L., Borokhovski, E., Wallet, P. A., Wade, A., & Fiset, M. (2004). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. *Review of Educational Research, 74*, 379–439.

Brook, C., & Oliver, R. (2006). Exploring the influence of instructor actions on community development in online settings. In N. Lambropoulos & P. Zaphiris (Eds.), *User-centred design of online learning communities* (pp. 342–364). Hershey, PA: Idea Group.

Coombs, P. H. (1985). *The world crisis in education: The view from the eighties*. New York: Oxford.

Couros, A. V. (2009). Open, connected, social: Implications for educational design. *Campus-Wide Information Systems, 26*(3), 232–239.

Cox, S., & Osguthorpe, R. (2003). Building an online instructional design community: Origin, development, and the future. *Educational Technology, 43*(5), 44–48.

Daniel, B. K., Schwier, R. A., & Ross, H. M. (2007). Synthesis of the process of learning through discourse in a formal learning community. *Journal of Interactive Learning Research, 18*(4), 461–477.

Downes, S. (2009). *MOOC and mookies: The connectivism & connective knowledge online course*. Retrieved from http://www.slideshare.net/Downes/mooc-and-mookiesthe-connectivism-connective-knowledge-online-course-presentation. December 9, 2011.

Eraut, M. (2000). Non-formal learning and tacit knowledge in professional work. *British Journal of Educational Psychology, 70*(1), 113–136.

Fahy, P. J., Crawford, G., & Ally, M. (2001). Patterns of interaction in a computer conference transcript. *International Review of Research in Open and Distance Learning, 2*(1). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/36/74. December 9, 2011.

Garrison, D. R., Anderson, T., & Archer, W. (2003). A theory of critical inquiry in online distance education. In M. G. Moore & W. G. Anderson (Eds.), *Handbook of distance education* (pp. 113–127). Mahwah: Lawrence Erlbaum.

Heckscher, C., & Donnellon, A. M. (1994). *The post-bureaucratic organization*. London: Sage Publications.

Hudson, J. M., & Bruckman, A. S. (2004). The bystander effect: A lens for understanding patterns of participation. *The Journal of the Learning Sciences, 13*(2), 165–195.

Kirschner, P., Strijbos, J. W., Kreijns, K., & Beers, P. J. (2004). Designing electronic collaborative learning environments. *Educational Technology Research and Development, 52*(3), 47–66.

Klamma, R., Chatti, M. A., Duval, E., Hummel, H., Hvannberg, E. H., Kravcik, M., Law, E., Naeve, A., & Scott, P. (2007). Social software for life-long learning. *Educational Technology & Society, 10*(3), 72–83.

Livingstone, D. W. (1999). Exploring the icebergs of adult learning: Findings of the first Canadian survey of informal learning practices. *Canadian Journal for the Study of Adult Education, 13*(2), 49–72.

Livingstone, D. W. (2001). *Adults' informal learning: Definitions, findings, gaps and future research.* NALL Working Paper No. 21, OISE/UT, Toronto. Retrieved from http://www.oise.utoronto.ca/depts/sese/csew/nall/res/21adultsifnormallearning.htm. December 9, 2011.

Luppicini, R. (2007). *Trends in distance education: A focus on communities of learning*. Greenwich: Information Age Publishing.

MacGillivray, A. (2010). *Respected leaders' work with boundaries*. Retrieved from http://boundaryspanner.wordpress.com/2010/04/21/respected-leaders-work-with-boundaries/. December 9, 2011

Milheim, W. D. (2006). Strategies for the design and delivery of blended learning courses. *Educational Technology, 46*(6), 44–47.

Murphy, E., & Coleman, E. (2004). Graduate students' experiences of challenges in online asynchronous discussions. *Canadian Journal of Learning and Technology, 30*(2), 29–46.

Piezon, S. L., & Donaldson, R. L. (2005). Online groups and social loafing: Understanding student-group interactions. *Online Journal of Distance Learning Administration, 8*(4). Retrieved from http://www.westga.edu/~distance/ojdla/winter84/piezon84.htm. December 9, 2011.

Reeves, T. C., Herrington, J., & Oliver, R. (2004). A development research agenda for online collaborative learning. *Educational Technology Research and Development, 52*(4), 53–65.

Rovai, A. P., & Jordan, H. M. (2004). Blended learning and sense of community: A comparative analysis with traditional and fully online graduate courses. *International Review of Research in Open and Distance Learning*, *5*(2). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/192/274. December 9, 2011.

Schwier, R. A. (2007). A typology of catalysts, emphases and elements of virtual learning communities. In R. Luppicini (Ed.), *Trends in distance education: A focus on communities of learning* (pp. 17–40). Greenwich: Information Age Publishing.

Schwier, R. A. (2009). The elusive metaphor of community in virtual learning environments. In *Proceedings of ED-media 09*. Honolulu, Hawaii: Association for the Advancement of Computing in Education.

Schwier, R. A., & Daniel, B. K. (2007). Did we become a community? Multiple methods for identifying community and its constituent elements in formal online learning environments. In N. Lambropoulos & P. Zaphiris (Eds.), *User- evaluation and online communities* (pp. 29–53). Hershey: Idea Group Publishing.

Schwier, R. A., & Dykes, M. E. (2004). The struggle for community and content in virtual learning communities. In *Proceedings of Ed-Media 2004* (pp. 2976–2982). Lugano, Switzerland.

Schwier, R. A., & Dykes, M. E. (2007). The continuing struggle for community and content in blended technology courses in higher education. In M. Bullen & D. Janes (Eds.), *Making the transition to e-learning: Issues and strategies* (pp. 157–172). Hershey: Information Science Publishing.

Selman, G., Cooke, M., Selman, M., & Dampier, P. (1998). *The foundations of adult education in Canada* (2nd ed.). Toronto: Thompson Educational Publishing.

Selznick, P. (1996). In search of community. In W. Vitek & W. Jackson (Eds.), *Rooted in the land* (pp. 195–203). New Haven: Yale University Press.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *Elearnspace*. Retrieved from http://www.elearnspace.org/Articles/connectivism.htm. December 9, 2011.

Siemens, G. (2008). *What is connectivism (and theory comparison table).* Retrieved from http://docs.google.com/View?docid=anw8wkk6fjc_14gpbqc2dt.

Siemens, G. (2010). *What is the unique idea in connectivism?* Retrieved from http://www.connectivism.ca/?p=116. December 9, 2011.

Tough, A. (1971). *The adult's learning projects: A fresh approach to theory and practice in adult learning*. Toronto: Ontario Institute for Studies in Education.

Virtual Learning Communities Research Laboratory. (2009). *Virtual learning communities research laboratory*. Retrieved March 18, 2009, from http://www.vlcresearch.ca. December 9, 2011.

Wiley, D. (2010). *Thinking out loud about connectivism.* Retrieved from http://opencontent.org/blog/archives/1408#axzz0lgUZpK3N. December 9, 2011.

Zengeström, J. (2005). *Why some social network services work and others don't—or: The case for object-centered sociality*. Retrieved from http://www.zengestrom.com/blog/2005/04/why-some-social-network-services-work-and-others-dont-or-the-case-for-object-centered-sociality.html. December 9, 2011.

CyGaMEs: A Full-Service Instructional Design Model Harnessing Game-Based Technologies for Learning and Assessment

Debbie Denise Reese

Game-based instructional technologies tantalize with promise for enhanced teaching and learning. Some supporters anticipate game-based learning will engage learners with physics, history, and mathematics the way commercial games compel players to devote hours and dollars to gameplay (Prensky 2005). Others capitalize on the social aspects of multiplayer platforms, seeking to build students' identities around a shared sense of practice connected to academic disciplines as applied in the real (albeit virtually mediated) world (Shaffer 2005; Steinkuehler 2005). The Cyberlearning through Game-based, Metaphor Enhanced Learning Objects (CyGaMEs) approach targets the instructional applications of game-based learning. When the educational goal is instructional, computer-based game environments are ideal for making learning more intuitive because these games can prepare learners with experiences that serve as apt prior knowledge. Activation of apt prior knowledge is fundamental to meaningful learning, and instructional design models include it as a preliminary event of instruction (Gagné et al. 1992; Merrill 2002; Smith and Ragan 2005). When learners lack apt prior knowledge, as is often the case in fields like science (e.g., see Hestenes et al. 1992; Johnstone 1991), an instructional environment must provide experiences to act as scaffolds for knowledge acquisition (Merrill 2002). Learning scientists conceptualize this process as preparation for future learning (Bransford and Schwartz 1999; Schwartz et al. 2005). Videogames are uniquely suited to prepare learners for knowledge acquisition because:

1. Videogames instantiate as game worlds. Game worlds are rule-based systems with relational structure (e.g., Salen and Zimmerman 2004). *Instructional design application: Define the relational structure of the to-be-learned domain and use it as the game system. Design game world/system as analogs of the to-be-learned.*

D.D. Reese, Ph.D (✉)
Center for Educational Technologies, Wheeling Jesuit University,
316 Washington Avenue, Wheeling, WV 26003, USA
e-mail: debbie@cet.edu

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2. Players engage in gameplay. Gameplay manipulates game system rules as transactions through which players change the state of the game world (e.g., Fullerton 2008). *Instructional design application: Design gameplay to manipulate game world relational processes analogous to the to-be-learned domain.*
3. Goals and subgoals direct, motivate, and reward gameplay (e.g., Reese 2007, 2009b; Schell 2008). *Instructional design application: Design goal structures that direct the player to discover and apply game world analogs of targeted relational structure.*
4. Players construct mental models of the game world through discovery-based gameplay as guided by game goals (Wright 2004, 2006). *Instructional design application: Ensure game world, gameplay, and game goals are analogs of the to-be-learned so that players construct preconceptual mental models that serve as viable prior knowledge.*

Like cartography, the CyGaMEs approach to instructional game design maps structure to a representation. Each aspect of the instructional game must map onto the to-be-learned domain and instructional goals. The result is a game world analog of a targeted (to-be-learned) conceptual domain:

- The game world shares relational structure with the target domain: The relational structure of the target domain becomes the relational structure of the game world.
- Gameplay is the procedural activity of that system of rules, goals, and subgoals, and it maps onto targeted learning goals and outcomes.
- Players' mental model of the game world is a consistent and shared preconceptual, viable mental model for the target domain.

By playing in such a game world, players experience episodes of gameplay that provide direct, embodied experience analogous to targeted learning.

CyGaMEs is a formalism that proceeds by application of cognitive science analogical reasoning theories (e.g., Reese 2009b; Reese and Coffield 2005) about (a) the processes through which people ubiquitously map relational structure between analogs (Gentner 1983) and (b) how an individual's immediate goal structures direct and constrain that mapping (e.g., Holyoak and Thagard 1989, 1997; Spellman and Holyoak 1996).

Applying the CyGaMEs approach, my teams and I created the online, singeplayer game *Selene*: *A Lunar Construction GaME* (http://selene.cet.edu). During gameplay of 1–5 h (actual time requirement is idiosyncratic to the individual player), *Selene* players construct a preconceptual mental model of basic planetary science concepts (accretion, differentiation, impact crating, and volcanism) along with subconcepts like gravity, kinetic energy, and density. *Selene* players build the Earth's early Moon. Then players replicate the Moon's history from 4.5 billion years ago to the present day as they pepper it with impact craters and flood it with lava flows. Although *Selene* players interpret game objects as planetary bodies, game objects are only representations. When I look into the sky with a telescope, binoculars, or an unaided eye, I see the Earth's Moon. When I manipulate *Selene*'s Moon, I interact with the mapped representation of the real-life analog. The *Selene* environment also contains about 15 min of video instruction by lunar scientist

Dr. Charles A. Wood, during which he covers the concepts and illustrates them using images and animations from NASA and other planetary science institutions.

By leveraging the affordances of game-based technologies, the *Selene* game world approaches concrete manifestation of the abstract scientific model that lives in Wood's head (Reese 2007, 2009b). This is an important achievement because it means designers of instruction can translate concepts scientists *think* into procedures learners *do*. Papert (1980) coined the term body syntonic to refer to human proclivity to learn through association with the "individuals' sense and knowledge about their bodies" (Papert 1980, p. 63). When new knowledge syncs coherently with embodied knowledge, learning is more intuitive.

Selene is both a learning environment and a research environment. The CyGaMEs approach includes specifications for a suite of assessment tools that embed assessment of learning and perceived experience within gameplay (Reese 2010). *Selene*'s assessment tools (flowometer, timed report, and gesture report) provide reliable (Reese 2009a) and sensitive (Reese and Tabachnick 2010) measures of perceived experience (i.e., flow; for information about the flow construct and its measurement, see Csikszentmihalyi and Csikszentmihalyi 1988; Csikszentmihalyi and Larson 1987; Hektner et al. 2007) and learning. In addition to the embedded assessments, I have also designed external assessments that administer within the interstitial online environment that houses the instructional game. These provide measures for triangulation and validation, which have demonstrated effectiveness of the learning technology (Reese 2009a; Reese et al. 2009; Reese and Tabachnick 2010).

Today, it is expedient for any collaborative dialog describing and charting the frontiers of distance education to consider the efficacy of theoretically framed, empirically supported instructional design methods for instructional game design, development, implementation, and assessment. CyGaMEs is a unique, multidisciplinary approach invented by the author. Given the current climate of financial investment to harness educational gaming (e.g., MacArthur Foundation, National Science Foundation, NASA, Federation of American Scientists, etc.) coupled with the plethora of positions about how to design and implement game-based education (e.g., Barab et al. 2005; Gee 2003, 2005a, b; Salen 2007; Shaffer 2005; Steinkuehler 2005), this synopsis of the CyGaMEs research program (foundations, design, and assessment) is presented to support the position that instructional game design requires a formal approach that ensures alignment between instructional goals, content, assessment, and the game-based instructional environment.

Foundations

CyGaMEs is an application of cognitive science analogical reasoning theory. Analogical reasoning is a cognitive process. Like cartography, analogizing is a process of mapping from one domain (the source: typically relatively well known or concrete) to another (the target: typically relatively unfamiliar or abstract). When humans analogize, they use what they know (the source) to make inferences about what they do not know (the target). It is like using a topographic map to infer graphic features. Analogists know quite a bit about how analogical reasoning works (e.g., Gentner 1983; Gentner and Holyoak 1997; Gentner and Kurtz 2006; Gentner and Markman 1994, 1997; Hummel and Holyoak 1997). People map structure from the source to the target domain. Young children and novices typically map according to superficial characteristics, and their analogies may lead to misconceptions about the target domain. Analogies are stronger and a sounder base for teaching, learning, and higher-order reasoning when the mapped domains share large, deep (that is, densely branched, layered, and even cross-branched) relational structure. In fact, people prefer deep analogies based on relational structure rather than superficial attributes. Although the mapping and alignment processes are ubiquitous, fluent, and effortless in human reasoning, (a) the analogizer's immediate goals constrain how that person maps correspondences between domains, and (b) instructional applications of analogy are enhanced when learners overtly align source and target domain components (a mutual alignment task; see Kurtz et al. 2001).

Cognitive scientists define conceptual domains "as systems of objects, object-attributes, and relations between objects" (Gentner 1983, p. 156). Each system can be represented in a number of ways. CyGaMEs currently represents a target domain as a concept map (Novak and Gowin 1984) with labeled ovals to represent objects (concepts) and directional arcs to represent relations between concepts (Reese 2009b). When object attributes are nonrelational, they can be omitted from a mapping of relational structure (Gentner 1980).

Once a target domain is specified, the game domain (the source) is specified and designed such that the relational structure of the game world is an analog of the target domain. Theoretically and methodologically, this means the game designer and developer should use the target domain as roadmap, translating the relational structure into game activity and translating superordinate and subordinate concepts into game modules and objects, respectively.

Design

Obviate Oversight: Iterative Design

Will Wright observed that computer game design is a young field with nascent theoretical foundations (Langhoff et al. 2009). I have observed that game producers tend to approach mapping from target to source (game specification) rather casually. This can lead to inaccuracy and/or omission.

For example:

- *Dark collar realized as white ejecta ring*: In the *Selene* game's target domain specification, the branch ending in the concept "albedo" connects through the concept of a "collar." Planetary geologists have found that the energy of impact that forms a new crater also melts the target rock and some of the impactor. Some of this molten rock travels with ejecta to form a dark, glassy ring outside

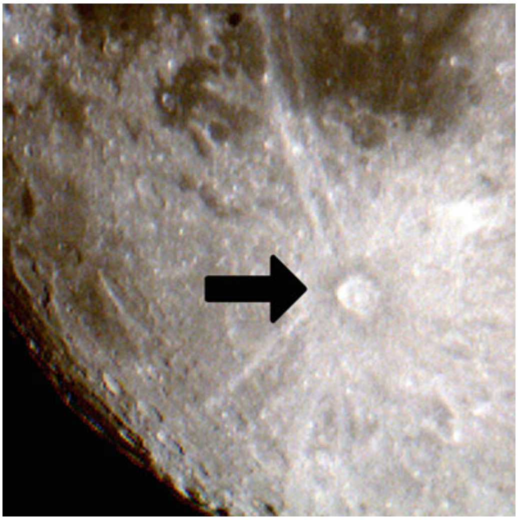

Fig. 1 A photograph of the Earth's Moon showcases Tycho's dark collar of impact melt. Copyright 2010 by Debbie Denise Reese

the rim of the new crater, like the dark collar that can be observed today on the young crater Tycho (see Fig. 1). Player's newly formed craters in the *Selene* game should be rimmed by a dark circle that weathers to a lighter color. The game currently skips the dark collar stage and represents only the white, weathered ejecta ring. The enhancement of collar representation is proposed for future versions.

- *Lacks representation of magma flow*: *Selene* target domain specification traces the conceptual path of how the Moon's mantle, liquefied into magma by radioactive melting, rose against gravity to flow through lava vents to the surface. The current game places each stream of magma flow to the surface as a static image, followed by dynamic pooling of lava on the surface. To fully model this component of the specification, the game should represent the direction of flow of magma as a growing line from the mantle to the surface. This enhancement is proposed for future versions.

Although the existing game version was viable in both cases, formative evaluation of the correspondence of the game mapping to target specification identified opportunity to enhance game alignment with the targeted science content by incorporating additional concept map nodes and relations.

Dialog: Enhancements Go Both Ways

Ongoing dialog and review between an instructional game producer and the CyGaMEs metaphorist throughout design and development help to obviate oversights. In addition, game design/developer insights may cause a CyGaMEs team to enhance target domain specification. Successful videogame professionals master many skill sets in addition to programming and graphics (Schell 2008). One of the designers of the *Selene* Classic accretion module concept used his expertise in astronomy and physics to elaborate gameplay aspects of kinetic energy and resultant heat. Formative evaluation in this case caused the metaphorist and subject matter expert to add more detail to the accretion concept map specification, specifying relations for the accretion effects due to kinetic energy.

Assessment

The CyGaMEs suite of embedded assessment tools measures learning and self-perceptions of affective state.

Timed Report: A Measure of Game-Based Learning

To the degree that a CyGaMEs game world (e.g., system, gameplay, goals) is a viable representation of the target domain specification, embedded assessment of player progress toward the game goal is a measure of the player's preconceptual mental model of the targeted content. Because the mental model is preconceptual, it is possible the player will be unaware of the targeted analogous content. Within the CyGaMes approach, the game is embodied experience of conceptual discovery that prepares the player with viable intuitions for the targeted content. Nonetheless, we have found that even one round of *Selene* gameplay is sufficient for players to infer viable relations about lunar geology concepts of accretion, differentiation, impact cratering, and volcanism (Reese et al. 2009). In one study, *Selene* players completed a mutual alignment task (external assessment) before entering the environment, after round 1 gameplay, and after round 2 gameplay. Half of the players, undergraduates from a psychology pool, had watched the instructional videos and half had not. After round 1, all players showed significant gains in the number of accretion concepts they listed when prompted to write all they knew or thought they knew about accretion ($F(2, 13) = 18.62$, $p < 0.001$, partial $\eta^2 = 0.74$). The effect due to instruction was not significant.

Using the CyGaMEs approach, player progress toward the game goal is a measure of the player's preconceptual mental model and perhaps, as suggested by the experimental results summarized above, the mental model itself. The CyGaMEs timed report is an embedded assessment tool that evaluates player progress toward the game. It is a measure of the player's mental model of targeted content. As currently designed, the timed report collects a measure of a player's progress toward the game goal every 10 s of gameplay, scoring +1, −1, or 0. If a player knows the domain, the timed report within an aligned game will graph as positive progress. The cumulative timed report plot adds each successive timed report score to those

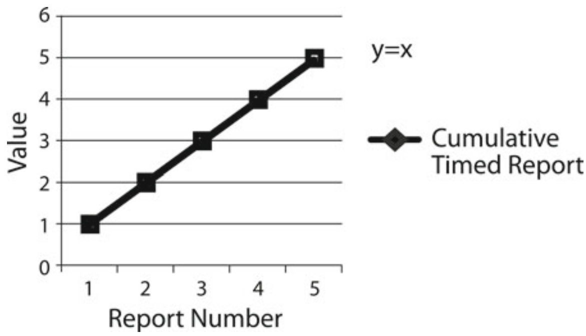

Fig. 2 Cumulative timed report value over time (report number) for an expert player in a correct CyGaMEs collected through a viable timed report algorithm. Copyright 2010 by Debbie Denise Reese

that precede it. For the knowledgeable player progressing toward the game goal, cumulative timed report should plot as a line with a positive slope. Within a viable CyGaMEs world with a viable timed report algorithm, the plot of cumulative timed report for a successful player should approximate a slope of 1, and the angle between the best-fit line and *X*-axis angle approaches 45° (see Fig. 2). In other words, perfect gameplay has a slope of 1 (1 unit of growth for every successive timed report).

Timed report can be used for (a) formative and summative evaluation of a CyGaME and (b) assessment of player knowledge.

Formative Evaluation Supporting Iterative Design

Formative evaluation provides information used to tune and hone a learning environment. As a formative evaluation tool, timed report analysis dictates and guides game revision. The cyclic process of development → formative evaluation → (revised) development → formative evaluation → development is often called iterative design. When the timed report for a knowledgeable player does not display an overall positive slope, there are three possibilities:

(a) Game world misaligns with targeted domain.
(b) Gameplay and progress toward the game goal are misaligned with the targeted domain.
(c) The timed report is misspecified.

Misaligned Game World

Simplifications are misalignments for which mapping retains the integrity of the relational structures leading to and away from the omitted concept. When the omitted concept's contribution to targeted learning goals is minimal, simplification may be permissible. Simplification reduces the depth of relational structure. Reduced systematicity limits the player's concurrent and future inferential potential.

Misalignments that modify targeted relational structure foster misconceptions and must be prohibited within an instructional game. Creators of instructional games must exercise vigilance during the initial round of design and development to obviate misalignment. The domain experts should review design scripts, storyboards, prototypes, and alpha builds for alignment. Early detection reduces the time and expense for revision: It is easy to revise a word in a design manuscript, easy to erase a line in a storyboard. These are cheap fixes. Game engine code revision—that is complex and expensive.

Misaligned Game Goal

The timed report was used to formatively evaluate gameplay and timed report instrument within a prerelease build of *Selene* II (http://selene.cet.edu). *Selene* II optimizes and enhances the original *Selene* Classic game about the origin and evolution of the Earth's Moon. *Selene* II contains two gameplay modules: Players discover and apply fundamental principles of planetary geology to build the Moon (accretion module) and then flood it with lava flows and pepper it with impact craters (surface features module).

Major targeted accretion concepts are:

- Low-energy collisions accrete; high-energy collisions fragment.
- Heat from collisions melted the protomoon into a magma ocean.

Analysis of CyGaMEs flowometer (embedded assessment of affective state through self-report within every 5-min interval, see Reese 2010) data during prerelease *Selene* II accretion scale 3 (the third and most challenging of the three accretion module levels) found players experienced high challenge and even the flow-inducing state of high challenge and high skill. Prerelease *Selene* II accretion scale 3 gameplay was tense and exciting. Absolutely! However, triangulation of timed report and *Selene* II gameplay data (player's gestures, specifically, the velocity at which they propel projectiles while attempting to accrete the Moon) identified misalignment. Timed report and velocity graphs of gameplay for knowledgeable and successful players revealed that accretion scale 3 gameplay characteristics both motivated and forced the prerelease accretion player's gameplay *away* from the targeted learning goals. To be successful in this early *Selene* II prerelease version of the accretion module, the player was forced to focus on accruing mass and radiation quickly before heat dissipated. This motivated high-energy collisions and disregard of accretion scale 3 density goal states. Timed report for a successful player flattened out or dipped as players successfully met the goal state. Use of embedded measure of players' gameplay collected through the timed report and the velocity gesture in formative evaluation informed adjustment of the accretion scale 3 targeted goal states for heat dissipation, critical mass, radiation, and heat.

Thus, timed report provided quantitative evidence to dictate and guide redesign of accretion scale 3 goal state thresholds.

Misspecified Timed Report

The *Selene* surface features module has three time periods. Players must learn that targeted concepts of impact cratering and volcanism over the Moon's 4.5 billion-year history had different amounts of activity during each time period. For example, during time period one, impact crater activity steeply declined and volcanism did not occur. The *Selene* Classic game goal states are static within each time period; the player must reach a goal threshold for impact cratering and for lava flow. The *Selene* II game enhanced surface features module gameplay by implementing a dynamic goal structure. Cratering and lava flow goal states update every second, and the game meter plots player progress against a graph of both impact cratering and lava flow goal states. Game goals in *Selene* II guide players to duplicate the targeted learning goals as embodied gameplay gestures.

Formative evaluation of the *Selene* II surface features module using timed report found that graphs for successful expert players failed to approach a slope of one (see Fig. 2). Although the timed report successfully represented the process of player learning (movement toward the game goal), it failed to reward the progress of experts who successfully applied their learning and maintained approximation of the targeted goal state.

In the case of *Selene* II surface features, the gameplay and goals were properly realized; it was the timed report algorithm that required an overhaul.

Will Wright said that instructional game design requires as much effort as commercial game design (Langhoff et al. 2009). Schell (2008) agrees. Instructional game design and development is tough work. The timed report can be used within formative evaluation to ensure that the game aligns with the targeted content and instructional goals.

Measuring Learning

Once the game and the measures are honed for accuracy, timed report functions as embedded assessment of player's knowledge growth and application. *Selene* measures learning as quantified behavior. For example, I identified a moment of learning for the underlying science of accretion (i.e., accretionLM: high-energy collisions fragment and low-energy collisions accrete), used velocity gesture data to identify the time in milliseconds at which each of 22 exemplar players achieved it, and divided timed report data into pre versus at and after (@&post) the learning moment. The timed report successfully ascertained when people had and had not learned accretionLM (Reese and Tabachnick 2010). The learning moment, in and of itself, explained 95% of the variance in player's progress.

The CyGaMEs team[1] developed and expanded an algorithmic approach to learning moment identification and plotting. Our goal is to generate rules for the *Selene* environment's backend reporting system to automate discovery, measurement, and reporting of the accretionLM and, eventually, other learning moments and perceived experience (flow and the other eight-channel states, see the next section and Massimini and Carli 1988). CyGaMEs staff has now run the elaborated accretionLM algorithm on 221 *Selene* Classic Accretion module scale 1 players' velocity and cumulative timed report data. This led us to discover a second type of gameplay activity.

In addition to identification of pre versus @&post learning for players demonstrating accretionLM, algorithmic classification identified that 30% of players modeled expert gameplay throughout by progressing continually toward the game goal (always progressing). Always progressing gameplay is an embodied replication of the accretion concept: that high-energy collisions fragment and low-energy collisions accrete.

The CyGaMEs Assessment Suite

In addition to the timed report, the CyGaMEs suite of assessment tools includes the flowometer and gameplay gestures.

The Flowometer: An Affective Measure of Perceived Experience

I derived the flowometer (Reese 2010) from Csikszentmihalyi's flow theory, instrumentation, and research (e.g., Csikszentmihalyi and Larson 1987). The flowometer prompts each player for a self-report of perceived experience during gameplay and other activity (e.g., instructional videos or cinematics). The flowometer prompts each player to self-report at a randomly selected but predetermined time within every 5-min interval. Players rate themselves from 0 (low) to 100 (high) for skill and challenge.

CyGaMEs follows an eight-channel flow (Massimini and Carli 1988) interpretation of challenge and skill data, with flow determined at times of high skill and high challenge. Other states are:

- Arousal. High challenge–lower skill
- Anxiety. High challenge–low skill
- Worry. Lower challenge–lower skill

[1] Thanks to Larry Hedges for the codevelopment of the learning moment concept, James Pustejovsky for the original algorithmic approach, and Ralph Seward for the algorithmic elaboration from exemplars to the *Selene* Classic corpus.

- Apathy. Low challenge–low skill
- Boredom. Low challenge–higher skill
- Routine expertise.[2] Low challenge–high skill
- Control. Higher challenge–high skill

CyGaMEs flowometer data measure individual and aggregate player trajectories. Results can be used for player screening, player assessment, and for environment evaluation. For example, flowometer data comparing aggregate player responses between *Selene* Classic and *Selene* II will determine if game modifications enhanced player experience.

CyGaMEs Gesture Reports

Gesture reports are also measures of game performance and learning. A CyGaMEs environment collects every player interaction with the environment that changes the game state. Each is a gesture, posted by the game as a gesture report. The game stamps each gesture with a time in milliseconds and with its location within the environment. Each gesture also includes its parameters. Above, I summarized the accretionLM study (Reese and Tabachnick 2010). CyGaMEs gestures were a critical component of this research. The accretionLM analysis examined the timed report and the accretion module slingshot gesture. During a slingshot, the player clicks to select a particle, drags to impart velocity (speed and direction), and releases to launch a particle. During accretion scale 1, players needed to learn and pro-perly apply the accretionLM concept by accurately launching particles with properly attenuated speeds. I visually inspected the plot of a player's velocities to determine if and when the learning moment occurred. Later, the CyGaMEs algorithm replaced visual inspection. The algorithm analyzed velocity to determine (a) existence of accretionLM, (b) the existence of an always progressing pattern, and (c) the accretionLM learning moment (for categorizing data as pre versus @&post learning).

Conclusions

The most powerful instructional design concept I ever learned was alignment: Align instructional goal with instructional strategy with assessment. CyGaMEs is all about alignment. CyGaMEs is a formalism for designing instructional games that align with targeted learning goals and content and assessment. Alignment of game, targeted content, and the timed report means the timed report measures player

[2] Csikszentmihalyi and his colleagues refer to this channel (state) as relaxation and gave the example of a rock climber scaling a familiar, challenging, but previously conquered rock face. I replace relaxation with a label that connotes the efficiency of highly practiced and perfected performance (Hatano and Inagaki 1986).

learning by quantifying player behavior. The CyGaMEs suite of embedded tools both (a) inform design and development of instructional games and (b) measure learning and affective experience. CyGaMEs is a theoretically founded method that has been successfully applied to design a videogame for teaching abstract science concepts and to measure player learning and experience. Initiatives, scholars, designers, and developers harnessing the power of game-based technologies for enhanced learning and assessment can build on CyGaMEs accomplishment.

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References

Barab, S., Thomas, M., Dodge, T., Carteaus, R., & Tuzun, H. (2005). Making learning fun: Quest Atlantis, a game without guns. *Educational Technology, Research and Development, 53*(1), 86–107.

Bransford, J. D., & Schwartz, D. L. (1999). Rethinking transfer: A simple proposal with multiple implications. *Review of Research in Education, 24*, 61–100.

Csikszentmihalyi, M., & Csikszentmihalyi, I. S. (Eds.). (1988). *Optimal experience: Psychological studies of flow in consciousness*. New York: Cambridge University Press.

Csikszentmihalyi, M., & Larson, R. (1987). Validity and reliability of the experience sampling method. *The Journal of Nervous and Mental Disease, 175*(9), 526–536.

Fullerton, T. (2008). *Game design workshop: A playcentric approach to creating innovative games* (2nd ed.). Burlington: Elsevier.

Gagné, R. M., Briggs, L. J., & Wager, W. W. (1992). *Principles of instructional design* (4th ed.). Belmont: Wadsworth/Thomson Learning.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave Macmillan.

Gee, J. P. (2005a). Learning by design: Good video games as learning machines. *e-Learning, 2*(1), 5–16.

Gee, J. P. (2005b). What would a state of the art instructional video game look like? *Innovate, 1*(6). Retrieved June 6, 2006 from http://www.innovateonline.info/index.php?view= article&id=80.

Gentner, D. (1980). *The structure of analogical models in science (report No. 4451, NTIS No. AD-A087-625)*. Springfield: National Technical Information Service, U.S. Department of Commerce.

Gentner, D. (1983). Structure mapping: A theoretical framework for analogy. *Cognitive Science, 7*, 155–170.

Gentner, D., & Holyoak, K. J. (1997). Reasoning and learning by analogy: Introduction. *American Psychologist, 52*(1), 32–34.

Gentner, D., & Kurtz, K. J. (2006). Relations, objects, and the composition of analogies. *Cognitive Science, 30*, 609–642.

Gentner, D., & Markman, A. B. (1994). Structural alignment in comparison: No difference without similarity. *Psychological Science, 5*(3), 152–158.

Gentner, D., & Markman, A. B. (1997). Structure mapping in analogy and similarity. *American Psychologist, 52*(1), 45–56.

Hatano, G., & Inagaki, K. (1986). Two courses of expertise. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), *Child development and education in Japan* (pp. 262–272). New York: W. H. Freeman and Company.

Hektner, J. M., Schmidt, J. A., & Csikszentmihalyi, M. (2007). *Experience sampling method: Measuring the quality of everyday life*. Thousand Oaks: Sage.

Hestenes, D., Wells, M., & Swackhamer, G. (1992). Force concept inventory. *The Physics Teacher, 30*, 141–158.

Holyoak, K. J., & Thagard, P. (1989). Analogical mapping with constraint satisfaction. *Cognitive Science, 13*, 295–355.

Holyoak, K. J., & Thagard, P. (1997). The analogical mind. *American Psychologist, 52*(1), 35–44.

Hummel, J. E., & Holyoak, K. J. (1997). Distributed representations of structure: A theory of analogical access and mapping. *Psychological Review, 104*(3), 427–466.

Johnstone, A. H. (1991). Why is science difficult to learn? Things are seldom what they seem. *Journal of Computer Assisted Learning, 7*(2), 75–83.

Kurtz, K. J., Miao, C.-H., & Gentner, D. (2001). Learning by analogical bootstrapping. *The Journal of the Learning Sciences, 10*(4), 417–446.

Langhoff, S., Cowan-Sharp, J., Dodson, E., Damer, B., Ketner, B., & Reese, D. D. (2009). *Workshop report: Virtual worlds and immersive environments (NASA/CP-2009-214598)*. Moffett Field: NASA Ames Research Center.

Massimini, F., & Carli, M. (1988). The systematic assessment of flow in daily life. In M. Csikszentmihalyi & I. S. Csikszentmihalyi (Eds.), *Optimal experience: Psychological studies of flow in consciousness* (pp. 266–287). New York: Cambridge University Press.

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development, 50*(3), 43–59.

Novak, J. D., & Gowin, D. B. (1984). *Learning how to learn*. New York: Cambridge University Press.

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Prensky, M. (2005). "Engage me or enrage me" What today's learners demand. *Educause Review, 40*(5), 60–65.

Reese, D. D. (2007). First steps and beyond: Serious games as preparation for future learning. *Journal of Educational Media and Hypermedia, 16*(3), 283–300.

Reese, D. D. (2009a). *Replication supports flowometer: Advancing cyberlearning through game-based assessment technologies*. In Paper presented at the 2009 International conference of the association for educational communications and technology, October 2009, Louisville, KY.

Reese, D. D. (2009b). Structure mapping theory as a formalism for instructional game design and assessment. In D. Gentner, K. Holyoak, & B. Kokinov (Eds.), *New frontiers in analogy research: Proceedings of the 2nd international conference on analogy (Analogy '09)* (pp. 394–403). Sofia, Bulgaria: New Bulgarian University Press.

Reese, D. D. (2010). Introducing flowometer: A CyGaMEs assessment suite tool. In R. V. Eck (Ed.), *Gaming & cognition: Theories and perspectives from the learning sciences* (pp. 227–254). Hershey, PA: IGI Global.

Reese, D. D., & Coffield, J. (2005). Just-in-time conceptual scaffolding: Engineering sound instructional metaphors. *International Journal of Technology, Knowledge, and Society, 1*(4), 183–198.

Reese, D. D., Diehl, V. A., & Lurquin, J. L. (2009). *Metaphor enhanced instructional videogame causes conceptual gains in lunar science knowledge.* In Poster presented at the association for psychological science 21st annual convention, San Francisco, May 2009.

Reese, D. D., & Tabachnick, B. G. (2010). The moment of learning: Quantitative analysis of exemplar gameplay supports CyGaMEs approach to embedded assessment. In J. Earle (Ed.), *Building a knowledge base to inform educational practice in STEM: Examples from the REESE portfolio*. Symposium conducted at the annual meeting of the Society for Research on Educational Effectiveness, Washington. Structured abstract retrieved March 4, 2010 from http://www.sree.org/conferences/2010/program/abstracts/191.pdf.

Salen, K. (2007). Gaming literacy studies: A game design study in action. *Journal of Educational Media and Hypermedia, 16*(3), 301–322.

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. Cambridge: MIT Press.

Schell, J. (2008). *The art of game design: A book of lenses*. New York: Elsevier.

Schwartz, D. L., Bransford, J. D., & Sears, D. (2005). Efficiency and innovation in transfer. In J. P. Mestre (Ed.), *Transfer of learning from a modern multidisciplinary perspective* (pp. 1–51). Greenwich, CT: Information Age.

Shaffer, D. W. (2005). Epistemic games. *Innovate, 1*(6). Retrieved June 6, 2006 from http://www.innovateonline.info/index.php?view=article&id=79.

Smith, P. L., & Ragan, T. J. (2005). *Instructional design* (3rd ed.). Hoboken: Wiley.

Spellman, B. A., & Holyoak, K. J. (1996). Pragmatics in analogical mapping. *Cognitive Psychology, 31*(3), 307–346.

Steinkuehler, C. A. (2005). *Cognition and learning in massively multiplayer online games: A critical approach.* 2006 dissertation, University of Wisconsin, Madison. Retrieved August 2, 2006 from http://website.education.wisc.edu/steinkuehler/thesis.html.

Wright, W. (2004). *Sculpting possibility space*. Keynote address presented at the Accelerating Change 2004: Physical space, virtual space, and interface conference, Stanford University, Palo Alto, CA. Retrieved June 16, 2010 http://cdn.itconversations.com/ITC.AC2004-WillWright-2004.11.07.mp3.

Wright, W. (2006). Dream machines. *Wired, 14*(4). Retrieved June 1, 2010 from http://www.wired.com/wired/archive/14.04/wright.html.

The Influence of Backchannel Communication on Cognitive Load

Jennifer A. Maddrell and Ginger S. Watson

Backchannel Communication

Synchronous computer-mediated communication (CMC) features within online conferencing systems offer distance education instructors and learners expanded opportunities for interaction, communications, and content sharing. The latest forms of live web-based conferencing technology, such as Elluminate Live and Adobe Connect, offer real-time audio and visual interfaces, along with public and private text-chat, Internet browsers, polling tools, application sharing, and whiteboards. Beyond a one-way broadcast of the primary instructional message, these synchronous conferencing technologies support simultaneous multichannel communication among all participants and foster the learners' immediate interactions with the instructional content, with the instructor, and with peer learners. No longer passive recipients of a single-channel instructional presentation, distance learners actively engage with content and others within the synchronous web-conferencing system during the live instructional presentation. Depending upon the features of the conferencing system, learners are able to annotate directly on the presentation slides while the presenter is speaking, route or receive files, send and receive links to web sites during the presentation, type viewable notes to the class in the margins of the presentation window, or engage in text-based conversations.

J.A. Maddrell, Ph.D (✉) • G.S. Watson, Ph.D
Darden College of Education, Old Dominion University,
Education 251-5A, Norfolk, VA 23539, USA

L. Moller and J.B. Huett (eds.), *The Next Generation of Distance Education: Unconstrained Learning*, DOI 10.1007/978-1-4614-1785-9_11,

While the audio and visual conferencing features tend to facilitate the main channel of communication in the live sessions, the text-chat feature often supports spontaneous and unfacilitated parallel (backchannel, sidebar, or side-talk) exchanges among participants that occur simultaneously with the instructional presentation. The opportunities for parallel communication and interaction are sparking debate among researchers and practitioners regarding what computer-mediated activities learners should engage in during live instructional sessions (Fried 2008). Learners' backchannel communication and interactions during lecture are viewed by educators as either a bold step forward in instruction that offers a new opportunity to facilitate increased content and human interaction or a form of virtual note passing that imposes an unnecessary distraction to the learning task at hand (Guess 2008).

While many studies have examined asynchronous CMC in distance education, far less research exists on distance learners' experiences within multimodal synchronous CMC learning environments (Bower and Hedberg 2010). Further, beyond studies and essays considering the use of simultaneous text-chat during conference proceedings or research examining synchronous CMC to facilitate student interaction outside the formal structure of a course (Dunlap and Lowenthal 2009; Kearns and Frey 2010; Yardi 2006, 2008), no research has examined learner experiences with parallel computer-mediated backchannel interaction during a live web-based conference.

The objective of this chapter is to consider both preliminary observations of participant backchannel communication in distance learning environments (Maddrell et al. 2012) and findings from other areas of research regarding learner interaction with instructional content, other learners, and the instructor to begin to assess how this new form of parallel synchronous CMC could influence a student's ability to learn. Given that cognitive load is a central consideration in interactive multimedia learning (Moreno and Mayer 2007), the primary task of this chapter is to consider where synchronous computer-mediated backchannel communication during online instructional presentation falls within the cognitive load equation. As discussed below, research based on cognitive load theory (CLT) suggests the parallel interaction may pose a negative distraction that unnecessarily increases extraneous cognitive load. However, the additional opportunities for real-time peer and teacher interaction and support within the parallel channels of CMC may enhance engagement, improve the facilitation of computer-mediated discourse, and foster student-to-student reflection and discussion of the subject matter.

Cognitive Load Theory and Research

CLT suggests that working memory imposes processing limitations that influence a learner's ability to process, encode, and retrieve information (Sweller and Chandler 1994). CLT is concerned with the learner's limited working memory processing capacity and the combined effect of intrinsic, extraneous, and germane cognitive load (Sweller et al. 1998). The inherent nature of the to-be-learned information imposes *intrinsic* cognitive load, while *germane* cognitive load is associated with processes that assist in learning, including processes facilitating schema acquisition and automation (van Merriënboer and Sweller 2005). *Extraneous* cognitive load does not support learning and can be imposed by inappropriate instructional design choices, such as the instructional message design, the instructional presentation, and interface choices related to the delivery mode (visual or verbal), modality (text or narration), and spatial arrangements on the page or screen (Lee et al. 2006).

Fundamental to CLT is the notion that the learning environment should eliminate irrelevant cognitive activities that do not lead to schema acquisition and automation thus hampering the processing of to-be-learned material (Sweller and Chandler 1994). Based on CLT, the instructional design of the learning environment should attempt to minimize extraneous load, optimize germane load, and manage intrinsic load (Kester et al. 2006). Sweller and Chandler (1994) suggest that high cognitive load is directly related to interactivity caused either by the nature of the to-be-learned material (intrinsic cognitive load) or by the presentation (extraneous cognitive load), or a combination of the two. High interactivity exists when the to-be-learned material includes numerous elements that must be simultaneously processed (van Merriënboer and Sweller 2005). If the element interactivity is low (hence the intrinsic cognitive load is low), then extraneous load may be less of a concern; but in complex learning situations where the intrinsic element interactivity is high, it is necessary to carefully manage the learning environment to avoid unnecessary instructional interactivity in order to reduce extraneous cognitive load (Sweller and Chandler 1994). Thus, a concern is whether synchronous CMC learning environments that facilitate instructional presentation through multiple channels of communication and interaction unnecessarily increase extraneous load.

Extraneous Cognitive Load

Are the parallel interactions a distraction that should be eliminated to reduce extraneous load? Given the similarity between backchannel interactions and practices that are outside acceptable traditional classroom norms, such as note passing or whispering to peers while the presenter is speaking, it is understandable why some would find backchannel interactions as distractions to the learning task. Theory and research may support the argument that learner backchannel interactions unnecessarily increase extraneous cognitive load. Moreno and Mayer (2007) examined interactivity as a characteristic of the multimodal learning environment in which the interactivity results in a variation in the instruction based on the learners' actions, including (a) *dialoguing* in which the learner asks questions and receives feedback, (b) *controlling* in which the learner establishes the pace or order of presentation, (c) *manipulating* in which the learner sets aspects of the presentation, (d) *searching* in which the learner seeks new information, and (e) *navigating* in which the learner selects from among content choices. Moreno and Mayer suggest the interactivity should be considered on a continuum from *no interactivity* to *high interactivity* and conclude that the challenge for designers working in interactive multimodal learning environments is to use the interactivity to increase generative cognition while at the same time reducing extraneous cognitive load imposed by the interactivity.

Research suggests that instruction requiring learners to devote their attention to multiple sources of information may unnecessarily cause extraneous cognitive load (Sweller and Chandler 1994). Studies involving laptop use in the classroom lecture setting suggest that learners' computer-mediated interaction (i.e., chatting and e-mailing) during lecture is a potential source of distraction and cognitive overload and that students' laptop use is negatively related to several measures of learning when the laptop use is not purposefully integrated into the lecture (Fried 2008).

Similarly, observations of backchannel text-chat communication during live web-conferenced instructional presentations suggest that learners can become overwhelmed when they attempt to follow both the instructional presentation and the parallel text-chat (Maddrell et al. 2012). During one observed presentation, the speaker asked the students if he was going too fast. One student responded in a typed text-chat post, "I don't think you are going fast—just trying to keep up the chat alongside AND listen attentively to you is the challenge!" while another added, "I agree … too much going on at once." Given these observations and suggestions from CLT and research, an important question is whether the interactivity involved with backchannel communication is extraneous load within the learning environment or germane to the process of learning.

Germane Cognitive Load

Instructional activities that encourage mental effort in schema construction and automation are processes that optimize germane cognitive load (van Merriënboer and Sweller 2005). Computer-mediated instructional technologies have long been valued for their ability not only to facilitate direct teaching but also to assist learners as they actively select, organize, and integrate new information (Winn 2004). Some suggest that synchronous computer-mediated discussion helps learners move from surface understanding to deeper learning as they reflect and respond to questions from peers and the instructor (Havard et al. 2005), which is viewed by some as a difference between facilitating information acquisition and supporting knowledge construction (Moreno and Mayer 2007). Are backchannel interactions germane to the learning process as part of effective presentation, communication, and dialogue to support the learner? Do these interactions help learners engage and reflect upon the material, create meaning from the presented content, and process the to-be-learned material within memory? As discussed below, research suggests that the parallel CMC may optimize germane cognitive load by promoting task engagement and supporting computer-mediated discourse. In addition, the increased opportunities for learner-to-other interaction may foster increased levels of teaching, cognitive, and social presence thereby leading to more meaningful learning outcomes.

Task engagement. Research suggests that when integrated within the course and monitored by the instructor, computer use during classroom presentation can enhance classroom interactions and learner participation that, in turn, increases engagement, motivation, and active learning (Fried 2008). While *nondirected* computer use during classroom presentation (such as checking personal e-mail) can lead to learner distraction, directed computer use has been found to facilitate the learners' understanding of the subject material, support immediate feedback and help, promote multiple interactions among learners and instructors, and offer learners the ability to share work, ideas, and learner interpretations (Barak et al. 2006). One observation of a large web-conferenced instructional presentation incorporating a text-based backchannel reported over 74 participants made 1,360 text-chat posts during the 95-min session with several students making more than 50 posts (Maddrell et al. 2012). In this observed session, participants made an average of 14 text-chat posts every minute suggesting that the backchannel fostered a very high level of learner engagement. Research suggests that some participants in synchronous CMC find the physical separation provides a freedom from distraction, which allows them to become more self-disclosing and engaged in the task due to factors such as increased anonymity, a sense of altered responsibility, and novel or unstructured situations (Coleman et al. 1999).

Conversational effectiveness. The classic Shannon and Weaver (1963) communication model focuses on a single channel from sender to receiver and suggests an autonomous view of conversation in which the listener passively receives information delivered from the speaker. From this perspective, the backchannel conversation is noise that hinders the communication of focus. However, others argue communication is not just for information transmission but also for co-construction of the message in which dialogue evolves from the *reciprocal influence* between narrators and listeners (Bavelas et al. 2000). Dialogue analysis research suggests that speakers monitor their own speech and adjust their presentations based on their assessments of the listeners' level of understanding (Clark and Krych 2004). As such, dialogue consists of two types of activity, including (a) support for the primary presentation of information and (b) management of the dialogue itself, facilitated in both a front (or main) channel with the primary speaker and in a backchannel including the speech and signals from others occurring at same time as the primary speaker's turn (Bangerter and Clark 2003).

However, communication research suggests that technology-mediated discourse differs from face-to-face communication and is generally characterized by longer turns, fewer interruptions, less overlaps, and increased formality in switching among speakers which may affect conversational effectiveness or the degree to which the mutual conversational goals are achieved (Marshall and Novick 1995). In addition, decreased levels of communication (as compared to face-to-face communication) may be the result of reduced use of speech acknowledgements or typical social greetings (DeSanctis and Monge 1998).

While research indicates that participants engaging in CMC conversation may experience difficulty in establishing meaning of information and managing feedback in conversation, attention to maintaining mutual understanding across the group can help to ensure effective communication (DeSanctis and Monge 1998). Cogdill et al. (2001) propose that backchannel interactions in digital conversations fall into one of five categories: (a) *process-oriented* interactions which steer the main channel discourse, (b) *content-oriented* interactions which respond to the content in the main channel, (c) *participation-enabling* interactions which include assistance to participants, (d) *tangential* interactions which branch from or continue a completed main channel discussion, and (e) *independent* interactions which are private and unrelated to the main channel. During one observed large web-conferenced instructional presentation, the text-based posts from students reflected this range of backchannel interactions (Maddrell et al. 2012). The text-based posts made as the presenter spoke acted as feedback signals from students that formed a shared conversation across the participants. At various times during the observed session, students posted links or resources related to the speaker's presentation, informed the speaker about their perceptions and experiences with the topic of the presentation, asked for clarification on the presenter's comments, offered support or guidance to peers, or challenged others to consider different ideas.

Meaningful learning through critical inquiry and discourse. Social constructivists view CMC technologies as vehicles to support student-to-student co-creation of meaning and understanding (Paulus 2007). The Community of Inquiry (CoI) was proposed as a conceptual framework for the optimal use of text-based asynchronous CMC to support critical thinking, critical inquiry, and discourse among distance education students and teachers (Garrison et al. 2000). Garrison et al. (2000) suggest the CoI as a guide to student and teacher interaction and communication that supports the learning process. The goal of a CoI is to facilitate critical reflection on the part of the learner and critical discourse among the teacher and peer learners. The CoI framework suggests that distance learning environments supported by CMC must include three essential elements (cognitive presence, social presence, and teaching presence) in order to foster the development and practice of higher-order thinking skills. Cognitive presence is defined within the CoI framework as the extent to which distance learners construct meaning through both critical reflection and discourse and is considered to be a vital element in critical thinking (Garrison et al. 2000). Cognitive presence is operationalized through a group-based inquiry process focusing on four phases of critical inquiry, including (a) the triggering event, (b) exploration, (c) integration, and (d) resolution. Social presence is the degree to which learners feel connected while engaging in mediated communication. Some argue that while social presence alone will not ensure the development of critical discourse, it is difficult for such discourse to develop without it (Garrison and Cleveland-Innes 2005). Teaching presence is described as a binding element in a CoI that influences the development of both cognitive and social presence through the direction and leadership of the educational experience.

Could the synchronous backchannel support a CoI and encourage immediate meaningful learner reflection? Does the communication and interaction within the backchannel foster critical discourse and co-creation of knowledge? Based on observations of teacher and learner text-chat posts during live web-conferenced instructional presentations, the backchannel communication included many indicators of teaching, social, and cognitive presence (Maddrell et al. 2012). In one 90-min live session, the teacher actively participated in the backchannel and made 64 text-chat posts, including short messages that (a) focused learner attention ("important point!"), (b) offered support ("if there is something you want me to ask, feel free to send me a private message here"), and (c) responded to student comments and questions about the session ("give this some time, but I would invite you to ask that question near the end"). Participants also engaged in social exchanges, including humor ("I am a talkative lurker ☺"), self-disclosure ("Trying to keep up—I'm definitely engaged, but find it difficult to interact … I don't type very fast, for instance!"), and salutations ("Gotta run … have a great end of the week!"). However, the observed peer-to-peer discourse did not progress beyond the triggering or exploration phases of the above noted group-based inquiry process with most exchanges simply raising a question, making a comment, or sharing personal opinions and stories without meaningfully contradicting or integrating ideas among the participants. This observation of relatively low levels of cognitive presence within the backchannel is similar to findings from other studies that suggest learner discussions in CMC-supported environments rarely move beyond sharing and comparing of information (Gunawardena et al. 1997; Paulus 2007). Therefore, while CoI research suggests that perceptions of social presence, cognitive presence, and teaching presence are related to perceptions of learning by students (Arbaugh 2008), it remains unclear whether the students' perceptions of learning and community are associated with critical discourse and meaningful learning outcomes (Rourke and Kanuka 2009).

Taken together, theory and research suggest that the backchannel fosters engagement in the learning task and helps to overcome some of the obstacles associated with computer-mediated discourse by providing presenters with signals (or markers) that allow presentation adjustment based on text-based cues from the learners. In addition, the learner responses and discourse in the backchannel may enhance and shape the main channel message of the presentation while providing on-the-fly reflection that the instructor can monitor to adjust the presentation based on the learners' responses. However, the synchronous backchannel may not provide support for meaningful reflection and co-creation of knowledge among learners.

Intrinsic Cognitive Load

Research suggests content presented in segments more effectively manages intrinsic cognitive load (Mayer and Moreno 2003). In addition, research indicates that content sequencing is most effective when based on the learners' level of expertise and that the preplanning of content sequencing becomes less important if the sequencing can be continuously adapted during the instructional presentation based upon observation of the learners' expertise (van Merriënboer and Sweller 2005). Does learner communication within the backchannel help presenters more effectively sequence and segment instruction? In turn, could these interactions manage intrinsic cognitive load?

Tied to the research discussed, it is possible that the backchannel provides presenters with signals or markers from the learner to gauge their level of understanding, which would allow an adjustment to the presentation based on the cues from the learners. As noted, dialogue research suggests that speakers actively monitor their own speech and adjust their presentation based on their assessment of the listener's level of understanding (Clark and Krych 2004). Listener backchannel responses, also referred to as project markers, play a role in shaping the presentation by providing the speaker with markers to chart progress and by signaling to the presenter that the listener is ready to transition with the presentation, including (a) acknowledgement tokens in which the listener acknowledges the presentation through utterances, such as "uh-huh," (b) agreement tokens in which the listener agrees with the presenter's position, such as "right," and (c) consent tokens in which the listener approves of the presenter's comments, such as "okay" (Bangerter and Clark 2003). These project markers provide the primary speaker with marks to chart progress and signal to the presenter that the listener is ready to transition with the presentation. For example, the listener can offer the speaker (a) *continuers*, such as "yes," which signal the listener is ready to hear more, (b) *assessments*, such as reactions of "wow" or "gosh," which signal comprehension and evaluation of what has been said, or (c) *recipiency* markers which signal the listener wants to speak. Text-chat posts from students during observed live web-conferenced instructional sessions suggest that the backchannel included many listener responses that allowed the presenter to gauge the level of understanding and readiness to transition within the presentation (Maddrell et al. 2012). Students frequently signaled the presenter with text-chat posts that either responded to the presenter's direct questions (yes/no or other responses) or offered spontaneous feedback of their reactions to the presenter or other students.

If backchannel interactions are signals from the learner as listener, it is possible that the presenter could monitor the learners' backchannel conversations to manage intrinsic cognitive load by assessing when the learners are ready to make transitions within the presentation. Cues from the learners' interactions in the backchannel may help the presenter to segment and sequence the presentation of content based on the learners' responses of either understanding or confusion thereby helping to manage intrinsic cognitive load. By monitoring the learners' public backchannel conversations and by assessing when the learners are ready to make transitions within the presentation, the presenter could use the backchannel interactions to overcome some of the obstacles associated with commuter-mediated discourse. However, monitoring the backchannel may increase the instructor's own cognitive load and disrupt the flow of the instruction when the instructor stops speaking to read the backchannel.

Summary

While no research has examined the influence of backchannel interactions on distance learners in live web-conferencing environments, class observation and findings from other areas of research may shed light on the effects the backchannel has on cognitive load. From preliminary observations of students in presentation sessions that utilize synchronous web-based conferencing systems, as well as in research from laptop use during live face-to-face classes, CMC, and dialogue analysis, support exists for *both* negative and positive effects on cognitive load. The potential for distraction and high interactivity may indicate backchannel interactions place unnecessary extraneous cognitive load on learners. Yet findings may also suggest that the backchannel interactions directly facilitate learning through more effective processing of the to-be-learned material. Further, the signals and cues within the dialogue may help presenters to better sequence and transition within the presentation of content, which may help to manage intrinsic cognitive load.

These findings have implications for instructional designers and suggest a range of research questions. Do backchannel interactions distract the learners and interfere with their receipt of the instructional message? During live web-conferenced class sessions, could backchannel interactions help to monitor distance learners and guide the instructional presentation? How can the synchronous backchannel provide support for immediate meaningful reflection and feedback among participants? While clues exist in related research, new studies are needed to answer these questions and to better understand the influence of backchannel communication on students in today's online classrooms.

References

Arbaugh, J. B. (2008). Does the community of inquiry framework predict outcomes in online MBA courses? *The International Review of Research in Open and Distance Learning*, *9*(2). Retrieved January 20, 2010 from http://www.irrodl.org/index.php/irrodl/article/view/490.

Bangerter, A., & Clark, H. H. (2003). Navigating joint projects with dialogue. *Cognitive Science, 27*(2), 195. doi:10.1016/S0364-0213(02)00118-0.

Barak, M., Lipson, A., & Lerman, S. (2006). Wireless laptops as means for promoting active learning in large lecture halls. *Journal of Research on Technology in Education, 38*(3), 245–263.

Bavelas, J. B., Coates, L., & Johnson, T. (2000). Listeners as co-narrators. *Journal of Personality and Social Psychology, 79*(6), 941–952.

Bower, M., & Hedberg, J. G. (2010). A quantitative multimodal discourse analysis of teaching and learning in a web-conferencing environment—The efficacy of student-centered learning designs. *Computers & Education, 54*(2), 462–478.

Clark, H. H., & Krych, M. A. (2004). Speaking while monitoring addressees for understanding. *Journal of Memory and Language, 50*(1), 62–81.

Cogdill, S., Fanderclai, T., Kilborn, J., & Williams, M. (2001). Backchannel: Whispering in digital conversation. *Presented at the 34th annual Hawaii international conference on system science* (p. 8). Maui, HI.

Coleman, L. H., Paternite, C. E., & Sherman, R. C. (1999). A reexamination of deindividuation in synchronous computer-mediated communication. *Computers in Human Behavior, 15*, 51–65.

DeSanctis, G., & Monge, P. (1998). Communication processes for virtual organizations. *Journal of Computer-Mediated Communication, 3*(4). doi:10.1111/j.1083-6101.1998.tb00083.x.

Dunlap, J. C., & Lowenthal, P. R. (2009). Tweeting the night away: Using twitter to enhance social presence. *Journal of Information Systems Education, 20*(2), 129–135.

Fried, C. B. (2008). In-class laptop use and its effects on student learning. *Computers & Education, 50*(3), 906.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*(2–3), 87–105.

Garrison, D. R., & Cleveland-Innes, M. (2005). Facilitating cognitive presence in online learning: Interaction is not enough. *American Journal of Distance Education, 19*(3), 133.
Guess, A. (2008). Hey, you! Pay attention! *Inside higher Ed*. Retrieved June 17, 2008 from http://insidehighered.com/news/2008/04/18/laptops.
Gunawardena, C. N., Lowe, C. A., & Anderson, T. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal of Educational Computing Research, 17*(4), 397–431.
Havard, B., Jianxia, Du, & Olinzock, A. (2005). Deep learning: The knowledge, methods, and cognition process in instructor-led online discussion. *Quarterly Review of Distance Education, 6*(2), 125–135.
Kearns, L. R., & Frey, B. A. (2010). Web 2.0 technologies and back channel communication in an online learning community. *TechTrends, 54*(4), 41–51.
Kester, L., Kirschner, P. A., & van Merriënboer, J. J. (2006). Just-in-time information presentation: Improving learning a troubleshooting skill. *Contemporary Educational Psychology, 31*(2), 167–185.
Lee, H., Plass, J. L., & Homer, B. D. (2006). Optimizing cognitive load for learning from computer-based science simulations. *Journal of Educational Psychology, 98*(4), 902–913. doi:10.1037/0022-0663.98.4.902.
Maddrell, J. A., Morrison, G. R., & Watson, G. S. (2012). Examining backchannel synchronous computer-mediated communication during live online conferencing. *Manuscript in preparation*.
Marshall, C. R., & Novick, D. G. (1995). Conversational effectiveness in multimedia communications. *Information Technology & People, 8*(1), 54–79. doi:10.1108/09593849510081602.
Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38*, 43–52.
Moreno, R., & Mayer, R. E. (2007). Interactive multimodal learning environments. *Educational Psychology Review, 19*(3), 309–326.
Paulus, T. M. (2007). CMC modes for learning tasks at a distance. *Journal of Computer-Mediated Communication, 12*(4), 1322–1345. doi:10.1111/j.1083-6101.2007.00375.x.
Rourke, L., & Kanuka, H. (2009). Learning in communities of inquiry: A review of the literature. *The Journal of Distance Education, 23*(1), 19–48.
Shannon, C. E., & Weaver, W. (1963). *The mathematical theory of communication*. Urbana: University of Illinois Press.
Sweller, J., & Chandler, P. (1994). Why some material is difficult to learn. *Cognition & Instruction, 12*(3), 185.
Sweller, J., van Merriënboer, J. J. G., & Pass, F. (1998). Cognitive architecture and instructional design. *Educational Psychology Review, 10*, 251–296.
van Merriënboer, J. J. G., & Sweller, J. (2005). Cognitive load theory and complex learning: Recent developments and future directions. *Educational Psychology Review, 17*(2), 147–177. doi:10.1007/s10648-005-3951-0.
Winn, W. (2004). Cognitive perspectives in psychology. In D. Jonassen (Ed.), *Handbook of research on educational communications and technology* (Vol. 2, pp. 79–112). Mahwah: Lawrence Erlbaum Associates.
Yardi, S. (2006). The role of the backchannel in collaborative learning environments. In *Proceedings of the 7th international conference on learning sciences* (pp. 852–858). Bloomington, IN.
Yardi, S. (2008). Whispers in the classroom. In T. McPherson (Ed.), *Digital youth, innovation, and the unexpected*, The John D. and Catherine T. MacArthur Foundation Series on Digital Media and Learning (pp. 143–164). Cambridge: The MIT Press. Retrieved January 15, 2010 from http://www.mitpressjournals.org/doi/abs/10.1162/dmal.9780262633598.143.

Data, Information, Knowledge, Wisdom: A Revised Model for Agents-Based Knowledge Management Systems

Rémi Wognin, France Henri, and Olga Marino

At doctoral level, students should develop several research skills (Research Councils UK (RCUK) 2001). Creating and sharing knowledge are some of these skills. In our research, we are interested in supporting doctoral student communities in the creation and sharing of knowledge through distributed learning environments (Lea and Nicoll 2001). The creation and sharing of knowledge are knowledge management processes (Nonaka 1994). Therefore, knowledge management's theories, processes, concepts, and models should be taken into account while designing and developing a distributed learning environment, which could be seen as a knowledge management system.

Understanding the concepts of data, information, knowledge, and wisdom and recognizing their differences are important in knowledge management literature (Davenport and Prusak 1998; Tuomi 1999). The knowledge pyramid model proposed by Ackoff and Rowley, establishes a hierarchical relation between data, information, knowledge, and wisdom (Ackoff 1989; Rowley 2007). This model is a metaphoric concept. While many researches recognize these four stages in the building of knowledge from data or wisdom (Davenport and Prusak 1998; Tuomi 1999; Alavi and Leidner 2001), we haven't found any work addressing the question: what phenomenon occurs between each level of the knowledge pyramid hierarchy and what is its implication on the design and development of knowledge management systems? In our opinion, this question has never been addressed in depth. Therefore, we intend to address it in this paper. The paper is organized as follow: we present the conventional knowledge pyramid model followed by the description of the revised model of the knowledge pyramid and its implications for the design and development of knowledge management systems, and then we conclude indicating next steps of the research.

R. Wognin, Ph.D (✉) • F. Henri, Ph.D • O. Marino, Ph.D
Science and Technologies, Tele-university of the University of Quebec at Montreal, TELUQ-UQAM, CP 8888, succursale Centre-ville, Montréal, QC, Canada, H3C 3P8
e-mail: rewognin@yahoo.ca

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The Knowledge Pyramid Model

Some authors read the knowledge pyramid model hierarchy starting from data, then information, and then knowledge (Davenport and Prusak 1998; Alavi and Leidner 2001); wisdom is added to the last level (Davenport and Prusak 1998). We call that reading the bottom–up approach. Other authors including Tuomi (1999) argued that the hierarchy should follow the opposite direction which is the top–down approach. In this paper, we will not make any difference regarding the approaches because they do not matter. For instance, the intelligent processes between levels will remain almost the same regardless of the direction of reading.

Data is a set of discrete, objective, or isolated facts about events and the world (Davenport and Prusak 1998; Tuomi 1999). Information is data combined into meaningful structures (Tuomi 1999). Knowledge is meaningful information which is put into a context (Tuomi 1999). Nonaka (1994) defined knowledge as a dynamic human process of justifying personal beliefs as part of an aspiration for the truth. "Knowledge is created and organized by the very flow of information, anchored on the commitment and beliefs of its holder" (Nonaka 1994, p. 15). Hence, knowledge is interpreted information based on an agent's belief and put into a context. When values and commitment guide intelligent behavior, behavior may be said to be based on wisdom (Tuomi 1999). Thus, wisdom is an agent's ability to exploit data, information, and knowledge to behave efficiently based on rules in a specific context to reach its goal. Therefore, there are processes that convert data into information, information into knowledge, and knowledge into wisdom. There is also some kind of intelligence behind each process. The agent could be a human or an artificial intelligent agent (Wooldridge 2009).

Unfortunately, the current model of the knowledge pyramid doesn't take into account the processes that transform data into information, information into knowledge, and knowledge into wisdom.

The Revised Model of the Knowledge Pyramid

In this section, we explore the intelligent processes theories as theoretical background of the revised model. We then describe the processes involved in the knowledge pyramid model with respect to the intelligent processes theories. Finally, we present the revised model of the knowledge pyramid, which takes into account the intelligent processes involved between levels.

Intelligent Processes

To address our research question regarding the phenomenon, which occurs, between each level of the knowledge pyramid hierarchy, we analyze theories supporting intelligent processes. In particular, we study the integrated thinking model (Jonassen

2000), the higher order thinking (Resnick 1987), and the psychology of intelligence (Piaget 2001) as theoretical background to identify the cognitive mechanisms or types of intelligent processes which humans deploy in carrying out their activities as well as their relation to knowledge management processes and the knowledge pyramid.

The integrated thinking model (Jonassen 2000) offers the following classifications of thinking:

- *Content/Basic Thinking*: Accepted Knowledge, related to problem solving, designing, and decision making;
- *Critical Thinking:* Reorganized Knowledge, related to analyzing, evaluating, and connecting;
- *Creative Thinking:* Generated Knowledge, related to synthesizing, elaborating, and imagining;
- *Complex Thinking*: Combines Accepted Knowledge, Reorganized Knowledge, and Generated Knowledge.

Resnick (1987, p. 3) proposes some key features of higher order thinking, which:

- *is complex.* The total path is not "visible" (mentally speaking) from any single vantage point;
- *concerns nuanced judgment* and interpretation;
- *includes imposing meaning,* finding structure in apparent disorder;
- *is effortful.* There is considerable mental work involved in the kinds of elaborations and judgments required.

Finally, Piaget (1967, 2011) proposes four principal periods of the development of thought:

- The period under 4 years sees the development of a symbolic and preconceptual thought;
- From 4 to 8 years, there is developed, (…) intuitive thought;
- From 7 to 12 years "concrete operations" are organized;
- Finally, from 12 years and during adolescence, (…) completion of reflective intelligence.

Based on the work of Resnick, Jonassen, and Piaget, we are going to analyze the relationship between data and information, information and knowledge, and knowledge and wisdom.

Description of the Relationship Between Data and Information

As stated earlier, information is processed, organized, or structured data (Davenport and Prusak 1998; Alavi and Leidner 2001). This description of the concept of information says that to have information, one should treat, organize, or structure data. Therefore, in order to convert data into information, we need an intelligent mechanism or process, which knows how to organize or structure facts about the world.

When referring to the integrated thinking model (Jonassen 2000), we observe that the ability to organize or structure corresponds to critical thinking or reorganized knowledge. Resnick (1987) identified this intelligent process as finding structure in apparent disorder. We thus find that it is a very specific form of intelligence or cognitive process, which we call "structuring intelligence" or "extracting relevant meaning," which allows the transformation of data into information. That supposes also the intervention of an external agent in this process, indeed, based on the assumption that data are facts, they would not be able to transform themselves into information without external intervention. The external agent could be a human or "human like agent." We define human like agent as an intelligent agent based on the unified theories of cognition (Newell 1990). The reasoning process proposed above is not based on the direction of the structuring process either starting from data toward information or in reverse way. It is therefore important that this intelligent process appears as an explicit intermediate element between data and information in the knowledge pyramid model, which is not the case in the current model.

Description of the Relationship Between Information and Knowledge

Based on the definitions given at the beginning of the previous section, knowledge is a justified personal belief, which increases the effective capacity of an individual (Nonaka 1994). Knowledge is authenticated information, interpreted (Resnick 1987) and put into context with a meaning (semantics) (Davenport and Prusak 1998; Alavi and Leidner 2001). Information becomes knowledge through a human cognitive effort (Tuomi 1999). We call this cognitive effort "creative thinking." Creative thinking has at least two dimensions (1) personal (Polanyi 1962) and individual; (2) collective and social (Bandura 1986; Piaget 2001). The personal dimension of creative thinking allows the authentication, the interpretation, the setting in context, and the evaluation with respect to the norms, cultures, and values of the community. The collective and social dimension of creative thinking regulates the community by creating and managing norms, cultures, and values of the community. Creative thinking appears therefore in our revised model as an intermediate level between information and knowledge.

Description of the Relationship between Knowledge and Wisdom

Tuomi (1999) noted:

> When information is given meaning by interpreting it, information becomes knowledge. (…). As the human mind uses this knowledge to choose between alternatives, behavior becomes intelligent. Finally, when values and commitment guide intelligent behavior, behavior may be said to be based on wisdom (p. 105).

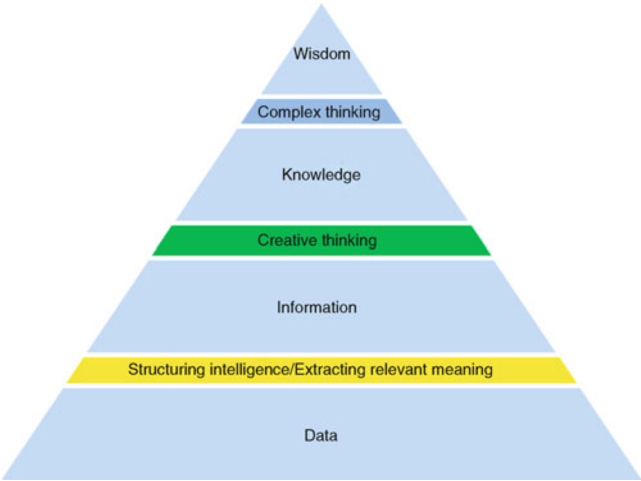

Fig. 1 Revised model of the knowledge pyramid with intelligent processes

Piaget (2001) identified a similar process called achieved intelligence. In the integrated thinking model and the higher order thinking this process corresponds to the complex thinking. We propose to add the complex thinking process between knowledge and wisdom in the revised knowledge pyramid.

Description of the Revised Model of the Knowledge Pyramid

The resulting revised model of the knowledge pyramid is a pyramid in which specialized intelligent processes relate two adjacent content types to each other. The resulting model has not only a hierarchical representation of content but also a corresponding identification of the cognitive processes that allow the content transformation. As shown in Fig. 1 the integration of the cognitive processes and concepts from the current model creates a seven steps structure, which includes in the bottom–up approach:

- *Data*: A set of discrete facts or entities about events and the world;
- *Structuring intelligence/Extracting relevant meaning*: Ability to reorganize in order to have structured data with meaning;
- *Information*: Structured data with meaning;
- *Creative thinking*: Ability to interpret information to generate knowledge based on one's beliefs, judgments, and decisions;
- *Knowledg*e: Interpreted information based on an agent's belief and put into a context;

- *Complex Thinking*: Ability to combine accepted knowledge (Content/Basic Thinking), reorganized knowledge (Critical thinking), and generated knowledge (Creative thinking);
- *Wisdom*: Ability to exploit data, information, and knowledge to behave efficiently based on rules in a specific context to reach goals.

Figure 1 shows the revised model of the knowledge pyramid.

Implications of the New Model for the Design and Development of Knowledge Management Systems

The second part of our research question concerns the implications of the revised knowledge management model on the design and development of knowledge management systems. From the preceding conceptual work, we can transpose the following findings:

1. Some concepts or expressions from knowledge management like: Belief, knowledge, human cognitive effort, mental structure, etc. suggest that knowledge management systems should reflect human behavior, mainly the way humans manage knowledge. In this sense, components-based architectures might not be the best choice for knowledge management systems. As those concepts are related to human characters or proprieties, we think that human like agents, which can exhibit some, or ideally most of human behaviors with respect to the revised knowledge pyramid model is the appropriate architecture for new generation of knowledge management systems which are based on multi-agent society where agents have human-like behavior;
2. One should also explore this question: As human beings, how do we learn? The answer to this question could lead to a different approach of designing which reflects the way humans manage knowledge in order to reproduce the mechanisms that humans deploy while managing knowledge in knowledge management system or in distributed learning environment;
3. Moreover, Nonaka's (1994) dynamic theory of organizational knowledge creation stated that the knowledge creation process starts from social interactions. The social interaction should be ideally between humans but when it is not possible for any reasons, it should be between human and human like agent, which in this case is represented by the distributed learning environment as a whole. It is not just about Human-Computer Interaction (Card et al. 1983) theory. In fact, it is deeper than that, it is about having the core distributed learning environment like a knowledge management system behaves as close as possible to the way human manages knowledge.

So, where should we start rethinking the new generation of knowledge management system design and development? Beyond knowledge management, psychology, and others theories, one way we could explore is to look at the Foundation for Intelligent Physical Agents (FIPA) standards (1996).

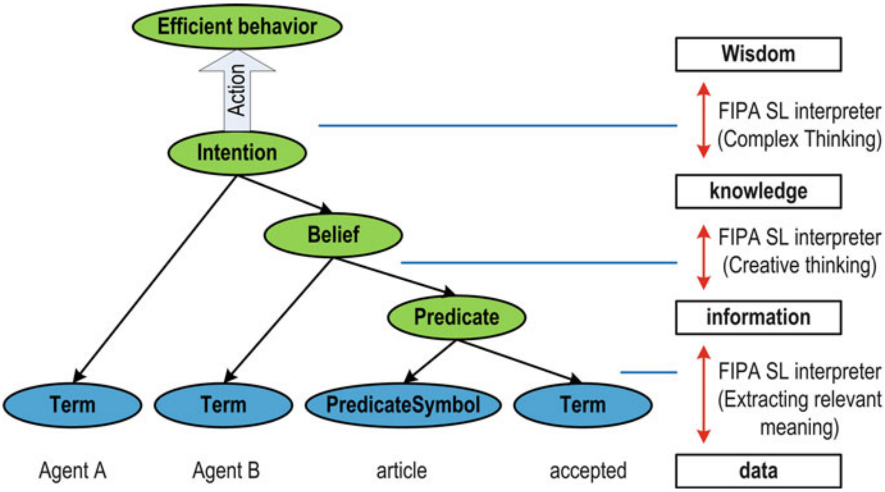

Fig. 2 The representation of the formula: (I AgentA (B AgentB (article accepted)))

The FIPA Communicative Act Library formal model (CAL 2002) is presented as:

<*i*, act (j, C)>
Feasible precondition (FP): φ1
Rational effect (RE): φ2

Then the correspondence to the standard transport syntax (AMR 2002) is illustrated by:

(act
:sender *i*
:receiver *j*
:content
C)

Where *i* is the agent of the act, *j* the recipient, act the name of the act, *C* stands for the semantic content or propositional content, and φ1 and φ2 are propositions.

For instance, based on the FIPA Communicative Act Library and the FIPA Semantic Language (SL) (2002) content language, the formula: (I AgentA (B AgentB (article accepted))), means AgentA has the intention that AgentB knows that the article is accepted then based on that knowledge, both agents could then exhibit appropriate behaviors which could be qualified as wisdom. This formula is among messages exchanged by doctoral students in agents-based distributed learning environment while engaged in articles review activities to develop research skills (RCUK 2001). The representation of the formula is shown in Fig. 2 as directed acyclic graphs where we can recognize the revised model of the knowledge pyramid as detailed below. The intelligent processes used in this example are FIPA SL interpreters:

- Data is represented by: AgentA, AgentB, article, and accepted;
- Extracting relevant information is a FIPA SL interpreter which has the ability to reorganize or structure data with meaning;
- Information is given by the Predicate (article accepted);
- Creative thinking is a FIPA SL interpreter which has the ability to interpret information to generate knowledge based on its beliefs;
- The agents acquire knowledge using the following expressions (B AgentB (article accepted)), (I AgentA (B AgentB (article accepted)));
- Complex thinking is a FIPA SL interpreter which has the ability to combine accepted knowledge, reorganized knowledge, and generated knowledge;
- Wisdom is the efficiency of Agents' behaviors based on their knowledge, information, and data in the pursuit of reaching their goals.

Conclusion

When it comes to build a knowledge management system to support human activities such as the development of research skills by doctoral students, it is amazing to note that there is no explicit link between the knowledge management concepts and models and the knowledge management system design and development processes. This paper has attempted to build a bridge between knowledge management concepts and models, and the knowledge management system design and development processes in order to reflect the way humans manage knowledge in knowledge management systems. It has proposed a revised model of the knowledge pyramid suitable for knowledge management system design and development. These findings have been shown to lead to a new way of designing and developing agents-based knowledge management systems to support humans while carrying out their activities. The future direction is to explore the FIPA SL interpreters for experiments and tests in doctoral students' activities context on the Tele-learning Operating System (TELOS) platform (Paquette et al. 2006).

References

Ackoff, R. L. (1989). From data to wisdom. *Journal of Applied Systems Analysis, 16*, 3–9.

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly, 25*(1), 107–136.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Card, S. K., Moran, T. P., & Newell, A. (1983). *The psychology of human–computer interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston: Harvard Business School Press.

FIPA ACL Message Representation in String Specification (AMR) (2002). Retrieved 10 May, 2010 from http://www.fipa.org/specs/fipa00070/SC00070I.pdf.
FIPA Communicative Act Library (CAL) (2002). Retrieved 10 May, 2010 from http://www.fipa.org/specs/fipa00037/SC00037J.pdf.
FIPA Semantic Language (SL) (2002). Retrieved 10 May, 2010 from http://www.fipa.org/specs/fipa00008/SC00008I.pdf.
Foundation for Physical Intelligent Agents (FIPA) (1996). Retrieved 10 May, 2010 from http://www.fipa.org/repository/standardspecs.html.
Jonassen, D. H. (2000). *Computers as mindtools for schools: Engaging critical thinking* (2nd ed.). Upper Saddle River, NJ: Prentice-Hall.
Lea, M. R., & Nicoll, K. (Eds.). (2001). *Distributed learning: Social and cultural approaches to practice*. London, UK: Routledge Falmer Press.
Newell, A. (1990). *Unified theories of cognition*. London: Harvard University Press.
Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science, 5*(1), 14–37.
Paquette, G., Rosca, I., Mihaila, S., & Masmoudi, A. (2006). TELOS, a service-oriented framework to support learning and knowledge management. In S. Pierre (Ed.), *E-learning networked environments and architectures: A knowledge processing perspective* (pp. 79–109). Berlin: Springer-Verlag.
Piaget, J. (1967). *Psychologie de l'intelligence*. Paris: A. Colin.
Piaget, J. (2001). *The psychology of intelligence*. New York, NY: Routledge.
Polanyi, M. (1962). *Personal knowledge*. Chicago, IL: The University of Chicago Press.
Research Councils UK (2001). *Joint Statement of the Research Councils'/AHRB's Skills Training Requirements for Research Students*. Retrieved 12 April, 2010 from http://www.rcuk.ac.uk/documents/researchcareers/jsstrainingrequirements.pdf.
Resnick, L. B. (1987). *Education and learning to think*. Washington, DC: National Academic Press.
Rowley, J. (2007). The wisdom hierarchy: Representations of the DIKW hierarchy. *Journal of Information Science, 33*(2), 163–180.
Tuomi, I. (1999). Data is more than knowledge: Implications of the reversed knowledge hierarchy for knowledge management and organizational memory. *Journal of Management Information Systems, 16*(3), 103–117.
Wooldridge, M. (2009). *An introduction to multi-agent systems*. Chichester, UK: John Wiley & Sons.

Collaborative Problem-Solving in Virtual Environments: Effect of Social Interaction, Social Presence, and Sociability on Critical Thinking

Rajashi Ghosh, Carolyn Rude-Parkins, and Sharon A. Kerrick

Introduction

This study explores questions of how increasingly complex virtual environments add value to teaching and learning of collaborative problem-solving. Some researchers say that if the virtual environment is media-poor and text-based, the level of communication and thus social interaction falls short of what is required to build a strong learning community (Daft and Lengel 1986). Nonverbal cues that convey socio-emotional information through facial expressions, posture, gaze, gestures, and audition are not exchanged in text-based online learning forums such as chat rooms. Communicating through audio is perceived to be significant for collaborative learning at a distance when compared to text-based chatting (Salinas 2005; Whittaker and O'Conaill, 1997; Matsuura et al. 1993; Short et al. 1976). Further, avatar-based virtual reality environments allow e-learners to interact through visual, text and even auditory channels in a simulated setting. The growing popularity of video games and 3-D movies suggests the appeal of greater levels of immersion. But does increased reality in the instructional environment impact social connection and learning?

R. Ghosh, Ph.D (✉)
School of Education, Drexel University, Room 218, One Drexel Plaza,
3001 Market Street, Suite 100, Philadelphia, PA 19104, USA
e-mail: rajashi.ghosh@drexel.edu

C. Rude-Parkins, Ph.D
University of Louisville College of Education and Human Development, Louisville, KY, USA

S.A. Kerrick, Ph.D
University of Louisville College of Business, Belknap Campus -Office 248,
Louisville, KY 40292, USA

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This study examined how social presence, sociability, and social interactions may affect critical thinking in groups in three types of collaborative virtual environments. Social presence is the ability of the users of the virtual environment to be able to emotionally and socially communicate as real people in that environment (Garrison and Anderson 2003). Sociability of virtual environments refers to how the environments might differ in facilitating the emergence of a social space that is conducive to social interaction in learning communities (Krejins et al. 2007). Social interactions are mutually interdependent actions between two or more e-learners in a collaborative virtual learning community (Mansour et al. 2006). And, critical thinking is a disciplined manner of thought that a person uses to assess the validity of something: a statement, news story, argument, research, etc. (Paul and Elder 2003).

Conceptual Framework

The researchers used the Community of Inquiry (Garrison and Anderson 2003) framework as the broad explanatory base to address the importance of collaboration in achieving higher-order learning outcomes in virtual learning environments. A critical community of learners is composed of "teachers and students transacting with the specific purposes of facilitating, constructing, and validating understanding, and of developing capabilities that will lead to further learning" (Garrison and Anderson 2003, p. 23). The community of inquiry advocates both cognitive independence and social interdependence as the fusion of individual and shared worlds enhances learning outcomes. According to Lipman (1991, as cited in Garrison and Anderson 2003), a community of inquiry is where:

> students listen to one another with respect, build on one another's ideas, challenge one another to supply reasons for otherwise unsupported opinions, assist each other in drawing inferences from what has been said, and seek to identify one another's assumptions. A community of inquiry attempts to follow the inquiry where it leads rather than being penned in by the boundary lines of existing disciplines (p. 15).

Thus, a community of inquiry encourages the students to reflect and engage in critical discourse that helps them to challenge their presumptions, diagnose misconceptions, and negotiate meaning through shared understanding of knowledge. It facilitates self-directed learning by allowing the students to take responsibility of their learning. Whether such a learning community can be supported in virtual environments is worth exploring as learning communities are conducive to group-level critical thinking and hence higher-level e-learning.

Garrison and Anderson (2003) identified three key elements of learning communities that might help educators to build an online community of inquiry. They are cognitive presence, social presence, and teaching presence. Cognitive presence is defined as the "extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (Garrison et al. 2001, p. 11). The outcome of cognitive presence is a process of critical thinking that is connected to the context (Garrison and Anderson 2003). In other words, socio-emotional communication facilitates cognitive presence, and cognitive skills are best developed in environments where e-learners can connect and communicate with their team members as real people (Gunawardena 1995).

Social presence is “the ability of participants in a community of inquiry to project themselves socially and emotionally, as real people, through the medium of communication being used” (Garrison and Anderson 2003, p. 28). This definition contrasts to some degree with the more commonly used definition of social presence as advocated by the Social Presence Theory by Short et al. (1976), which places greater emphasis on the technology or the media characteristics aspect of social presence instead of the participants or users.

Finally, teaching presence is defined as the “design, facilitation and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes” (Garrison and Anderson 2003, p. 29). While teaching presence is required to integrate all elements of a community of inquiry in a way that is congruent with the needs and capabilities of e-learners, social presence enables the teacher to encourage collaborative e-learning in computer-supported environments. The lack of verbal communication in certain virtual environments presents a special challenge for establishing social presence, making it difficult for e-learners to relate with their team members (Garrison and Anderson 2003).

The emergence of advanced communication media, such as audio conferencing, and avatar-based virtual environments makes it possible to engage in verbal communication in virtual environments and even to exchange visual cues. These technologies can decrease dependence on written communication as text can now be supplemented with spoken and graphical communication in online forums. Educators can now take advantage of different computer-supported collaborative environments for building social functionality. Understanding the efficacy of virtual collaboration environments for social functionality is required as it helps in building socially conducive learning platforms that facilitate collaborative learning by fulfilling e-learners’ learning and psychological needs. The following research questions are examined in this study to facilitate that understanding.

Research Questions

1. How are perceptions of social presence, sociability, and social interaction related to the type of virtual environment?
2. How are perceptions of social presence, sociability, social interaction related to critical thinking in groups across different virtual environments?

Literature Review

Developments in communication technology have encouraged educators to select optimal virtual learning environments that support and encourage collaborative learning among e-learners. As collaborative learning leads to critical thinking and shared understanding of knowledge, one of the goals of designers and educators teaching online courses is the implementation of a communication environment that can support active interaction and collaboration among e-learners (Johnson and Johnson 1999). Effectiveness of collaborative e-learning however depends on the quality of social interactions that take place in a virtual environment as it can influence critical thinking in virtual groups.

Social Interaction and Critical Thinking in Groups

Social interaction is vital for critical thinking in groups as it is believed to be the natural way people learn (Gunawardena 1995; Hiltz 1994; Liaw and Huang 2000; Northrup 2001). It is a prerequisite for building learning communities in cyberspace, as through interpersonal interactions e-learners can engage in critical discourse and social construction of knowledge (Bednar et al. 1995; Garrison et al. 2000). According to Krejins et al. (2003), there are two dimensions of social interaction: (a) educational, and (b) psychological or emotional. The dichotomy between these two factors of social interaction is evident in previous research studies (Brown and Yule 1983; Hare and Davis 1994) that categorized interpersonal interaction as either task driven or socio-emotional. Both task driven and socio-emotional interactions are required to promote caring and to develop committed group memberships in virtual learning communities (Krejins et al. 2004). However, online educators are naturally inclined to focus on task driven group interactions and consider the socio-emotional aspect to be a secondary factor (Krejins et al. 2003).

This lack of focus on socio-emotional dynamics in virtual group interactions is noted by Cutler (1996) (as cited in Krejins et al. 2004) who remarked that the extant literature on computer-mediated communication is almost entirely task-based focusing on cost, efficiency, and productivity with little attention given either to the changes effected on the people or to the social relations created from using the communication technologies. As online environments are used primarily for task-based activities, social and off-task communication are often ignored. As the off-task communication is critical for the e-learners to get to know each other, develop trust, belong to a community, and commit to social relationships in the community, online educators often fail to build successful communities of inquiry in cyberspace. (Krejins et al. 2003). Attention toward the factors that can facilitate such social interactions in virtual environments can help educators to improve online instructional effectiveness and to build effective communities of inquiry. According to Krejins et al. (2007), two such factors are social presence and sociability of virtual environments.

Social Interaction and Social Presence. Presence has to do partly with the technology and partly with the participants' state of mind. Tu (2002) linked social learning theory to social presence and remarked that "social presence is required to enhance and foster social interaction, which is the major vehicle of social learning" (p. 27). The connection of social presence with the construct of immediacy, defined by

Mehrabian (1969) as the communication behaviors that lead to increase in closeness and nonverbal interaction among learners implies that perceptions of social presence in a virtual environment may affect social interaction among e-learners and thus, may influence the effectiveness of virtual learning communities.

Social Interaction and Sociability of Virtual Environments. The association between sociability of virtual environments and social interaction is proffered by Krejins et al. (2007). They propose that different characteristics of these environments can influence e-learners' perceptions of a "sound" social space that fosters effective group relationships, trust, belongingness, and a strong sense of community through effective social interactions. Their canonical example of a water-cooler that attracts people to gather and engage in a social discourse in the real world elicits the importance of having electronic equivalents of such points of attraction in virtual environments that would invite e-learners to engage in social interactions. Sociable virtual environments help in developing interpersonal relationships among the e-learners who are potential members of a virtual learning community by offering a socially conducive learning environment.

Study Design

An experimental study design was used to investigate if e-learners' perceptions of social presence, sociability, and social interaction varied across three synchronous virtual environments (e.g., text chat, audio conference, or avatar-based online environment) and if their perceptions of social presence, sociability, and social interaction were associated with critical thinking in groups.

Participants

Participants were a convenience sample of junior and senior students enrolled in a Business Administration class in the College of Business of a Midwestern Urban Public University with a total undergraduate and graduate student population of approximately 21,600. This particular class was chosen because the topics of team building, critical thinking, and technology applications were appropriate for the course. The sample size was contingent on the professor's willingness to encourage her students to participate in simulation activities for the purposes of this study. Approximately 30 students participated in the simulations. Out of 30 participants, there were 19 males and 11 females with the average age of 25. Three students from Panama were participating in a study abroad program and were identified as proficient readers and speakers of English.

To recruit participants, the professor of the class made an announcement at the beginning of the semester that participation in an academic research study at the University during regular scheduled class time would give the students an opportunity to earn participation points. Those students not electing to participate in this study were offered alternative options to earn participation points for class. A written document explaining the study was provided. The University's Human Subjects Review approved the research design.

Assignment to Teams and Environments

Thirty participants from the class were divided into three groups by virtual environment with ten participants in each environment (e.g., online text chat, online audio conference, and online avatar-based). The ten participants in each environment were further subdivided into three teams with at least three members in each virtual team.

Online Environments

The virtual environments used in the study were synchronous computer-based interfaces that allow participants to interact with each other with varying degrees of realism through text, sound, and graphics. Application of virtual environments stems from the multimedia principle that people learn more deeply from words and graphics than from words alone (Clark and Mayer 2003).

Text Chat. The simplicity and immediacy of text chat makes it a useful learning tool. Studies report use of text chat for involving students in cooperation, discussion, questioning, and feedback, for office hours and live-class preparation. Problems in use of this medium include managing coherent interaction with multiple threads, turn taking, and topic change (O'Neill and Martin 2003).

For this study, the chat environment in Blackboard allowed participants to connect via synchronous text interaction. Participants were familiar with techniques to keyboard messages to others in the group, though the chat format was new to many.

Audio Conference. While communicating with others through audio tools is quite familiar, dealing with multiple talkers is not. Audio conference has similar advantages and disadvantages to text chat, in terms of support of instruction and interaction goals, as well as problems with managing the interaction. In addition, use of this medium in instructional settings has raised technical issues of sound quality and reliable connections (Hampel and Hauck 2004).

For this study, the audio environment in Wimba Conferencing allowed for realistic synchronous interaction.

Avatar-based Interaction. Schroeder (2002) defines virtual reality technology as computer-generated display that allows or compels the user (or users) to have a feeling of being present in an environment other than the one they are actually in and to interact with that environment. He further discusses shared virtual environments as systems in which users can also experience other participants as being present in the environment and interacting with them.

The avatar-based environment in Second Life allows participants to assume graphical identities for synchronous interaction via text and audio, in addition to body and environment cues. The ramped-up complexity is highly interesting but has a steeper learning curve than other environments discussed here. A prepared space in Second Life was used for this study, and the application used in this study did not include audio.

Group Critical Thinking Activities

Simulations from the Human Synergistics Survival Series (2007) set the scene for critical thinking in groups among virtual team members. Cascade Survival requires participants to rank the action steps in importance to team survival in a snow storm. Earthquake Survival requires participants to identify the action steps to survive in a building damaged by severe earthquake tremors and sequence those steps across the range of least to most dangerous steps. Print and video materials structure the scenario and give the scoring criteria for the individual and team problem solutions. Participants rank order problem solution individually, and then collaboratively in teams. The problem resolution framework for the Survival simulations includes rational skills and processes of analyzing the situation, setting objectives, simplifying the problem, considering alternatives, and discussing consequences. Interpersonal skills include listening, supporting, differing, participating, and striving for consensus.

The Cascades exercise was used on day 1 to familiarize participants with the virtual environment. Familiarization helped to control for any differences that might have occurred due to the participants' lack of exposure to any of the environments. The Earthquake exercise was used on day 2 and called for similar group interaction. Participants responded to an online survey presented in Survey Monkey with questions on social presence, sociability, social interaction, and critical thinking in groups.

Surveys

The demographics section of the survey contained eight items about participant's age, gender, ethnicity, year in school, proficiency with computers, the virtual environment assigned to them, the level of difficulty they perceived in using the virtual environment they were assigned, and their past exposure to that environment.

The section following demographics consisted of three parts to assess perceptions on social presence, sociability, and social interactions during the virtual group problem-solving activity. All items were answered with a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Social Presence was measured with 12 items developed by Lin (2006). Sociability was measured with ten items developed by Krejins et al. (2007). And, social interaction was measured with 25 items relational communication scale developed by Burgoon and Hale (1987).

The Critical Thinking section contained the eight-item scale developed from Paul and Elder's (2003) model of critical thinking. The researchers developed this scale to assess individual team member's perceptions of the level of critical thinking in groups during the online collaborative problem-solving activity. This study provides information about reliability and validity of the scale. The appendix includes this scale.

Finally, students were asked to answer open ended questions about the ease of collaboration in the virtual environment they used. Students assigned to the avatar-based setting (e.g., Second Life) were further asked to give their opinions about the lack of the audio feature in the version of Second Life used in the current study.

Data Analysis

Multivariate analysis of covariance (MANCOVA), correlation analysis, and cross-tabulation analysis helped the researchers to explore the relationships among social presence, sociability, social interaction, and critical thinking in groups across the three different types of synchronous virtual environment used in this study (e.g., text chat, audio conference, avatar-based interaction).

Principal component analysis (PCA) with varimax rotation helped the researchers to validate the scale developed to measure critical thinking in groups during the online collaborative problem-solving activity. The researchers added and averaged the responses on social presence, sociability, social interaction, and critical thinking in groups for all three teams in each environment to derive the score that represented participants' perceptions on those variables in each environment.

Study Results

Scale Reliability

To measure reliability of the scales contained in the survey, data were analyzed using Cronbach's coefficient alpha, a statistical procedure that indicates the extent to which the various items correlate in measuring the same variable. Table 1 presents the Cronbach's coefficient alpha for the various scales.

Scale Validity

The scales used in the study (e.g., social interaction, social presence, sociability, and critical thinking in groups) were subjected to PCA with varimax rotation for evidence of construct validity (Tabachnick and Fidell 2001). For the social interaction,

Table 1 Cronbach's alphas for research measures

Scale	Number of items	*N*	Alpha	*M*
Social interaction	25	28	0.722	3.24
Social presence	12	30	0.844	3.74
Sociability	10	28	0.810	3.64
Self assessment of critical Thinking	8	28	0.909	4.43
Group assessment of critical thinking	8	30	0.952	4.33

social presence, and sociability scales, in each case the PCA demonstrated a one-factor solution as predicted by the respective scales' authors.

For the scale developed to measure critical thinking in virtual groups, Bartlett's Test of Sphericity ($\chi^2 = 284.082$, $p < 0.001$) and the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.70) both suggested that the sample size and correlation matrix were appropriate for factor analysis. Directed further by the eigenvalue greater than one rule and a scree plot analysis (Tabachnick and Fidell 2001), the PCA with varimax rotation produced a one-factor solution. The factor explained 76.48% of the variance (e.g., eigenvalue of 6.12).

Principal Analyses

For Research Question 1 examining the influence of the type of virtual environment on perceptions of social presence, sociability, and social interaction, the researchers conducted a MANCOVA with the type of virtual environment (e.g., text chat, audio conference, and avatar-based) as the independent variable, social presence, sociability, and social interaction as the dependent variables and the demographic variables as the covariates. The Box's Test demonstrated that equal variances could be assumed ($p = 0.729$) at $p < 0.05$ level. Thus, Wilks' criterion was used to assess the test statistic. Wilks' criterion suggested absence of a multivariate main effect for the independent variable, the type of virtual environment (e.g., text chat, audio conference, and avatar-based) at $p < 0.05$ level. That is, there was no significant group difference by the type of virtual environment with respect to the combined three dependent variables, social presence, sociability, and social interaction. Wilks' $\Lambda = 0.714$, $F\ (6, 26) = 0.794$, $p = 0.583$.

This finding was followed with a correlational analysis in order to examine whether perceptions of user difficulty for the three types of virtual environments was associated with social presence, sociability, and social interaction in those environments. Following Cohen's (1988) effect size evaluation criterion, the correlation between user difficulty level in virtual environments and social presence was large ($r = 0.518$, $p < 0.01$) and the correlation between user difficulty level in virtual environments and sociability was medium ($r = 0.423$, $p < 0.05$), indicating that if the students perceive the type of virtual environment (e.g., text chat, audio conference,

Table 2 Intercorrelations Among User Difficulty in CSCL Environment, Social Presence, Sociability, and Social Interaction

Variables	1	2	3	4
User Difficulty	1			
Social Presence	0.518**	1		
Sociability	0.423*	0.613**	1	
Social Interaction	0.293	0.558**	0.463**	1

Note. $*p < 0.05$. $**p < 0.01$

Table 3 Cross-tabulation analysis with user difficulty in online environment and type of CSCL environment

User difficulty in online environment	Type of online environment			
	Online chat	Online audio conference	Online avatar-based	Total
Absent	9 (50%)	3 (16.7%)	6 (33.3%)	18
Present	1 (8.3%)	7 (58.3%)	4 (33.3%)	12

or avatar-based) easy to use, they are more likely to perceive higher levels of social presence and sociability in that particular virtual environment. However, no significant association was found between user difficulty and social interaction. See summary displayed in Table 2.

The researchers further conducted a cross-tabulation analysis in order to examine whether the absence or presence of perceived user difficulty depended on the type of virtual environment (e.g., text chat, audio conference, or avatar-based) assigned to the students. The continuous variable that measured the level of perceived user difficulty in virtual environments on a five-point Likert-type scale ranging from 1 (*very difficult*) to 5 (*very easy*) was converted into a categorical variable according to the following criterion: (a)<5 means user difficulty is present, and (b)=5 means user difficulty is absent. A significant Chi-Square statistic ($\chi^2 = 7.5$, $p < 0.05$) indicated that the two categorical variables were dependent on each other or in other words, the absence or presence of perceived user difficulty varied across the three types of virtual environments (e.g., text chat, audio conference, or avatar-based) used in the study. According to the cross-tabulation results, students perceived highest degree of user difficulty in audio conference followed by the avatar-based environment (e.g., Second Life). Text chat was perceived as the easiest virtual environment for the problem-solving activity conducted in this study. Thus, the level of perceived user difficulty in virtual environments showed significant associations with both the type of environment (e.g., text chat, audio conference, or avatar-based) and perceptions of social presence and sociability in online environments. See summary of cross-tabulation analyses displayed in Table 3.

For Research Question 2 examining the relationships among social presence, sociability, social interaction, and critical thinking in virtual groups during the collaborative problem-solving activity, we conducted a correlational analysis. Zero-order correlational values indicated that both social presence and sociability were significantly correlated with social interaction across the three types of synchronous virtual environments used in the study. Following Cohen's (1988) effect size

Table 4 Intercorrelations among social presence, sociability, social interaction, and critical thinking

Variable	1	2	3	4
Social presence	1			
Sociability	0.613**	1		
Social Interaction	0.558**	0.463**	1	
Critical thinking	0.684**	0.458*	0.406*	1

Note. *$p<0.05$. **$p<0.01$

evaluation criterion, the correlation between social presence and social interaction was large ($r=0.558$, $p<0.01$), and the correlation between sociability and social interaction was medium ($r=0.463$, $p<0.05$), indicating that if the students perceive higher levels of social presence and sociability in virtual environments (e.g., text chat, audio conference, and avatar-based), they are more likely to engage in higher levels of social interaction in that particular environment.

The correlational values further indicated that social presence, sociability, and social interaction were significantly correlated with critical thinking in groups across the three types of synchronous virtual environments used in the study. Following Cohen's (1988) effect size evaluation criterion, the correlations of social presence with critical thinking in group ($r=0.684$, $p<0.01$) was large, the correlations of sociability with critical thinking in group ($r=0.458$, $p<0.05$) was medium, and the correlation between social interaction and critical thinking in group ($r=0.406$, $p<0.05$) was medium. See summary displayed in Table 4.

Summary Model

Figure 1 depicts the variables and their relationships as explored by the research questions in this study and serve as an illustrative summary of the findings of the research questions. Note that the bidirectional arrows represent the correlational associations.

Discussion of Findings and Future Research Directions

The results of this study indicated that perceptions of social presence and sociability in collaborative problem-solving activity in three types of virtual environments depended more on the user or the student who was using the virtual environment than on the type of environment itself. Their perceptions of sociability, and social presence influenced the extent to which they engaged in social interaction in the virtual environment. The level of social interaction consequently affected critical thinking in the groups. In view of these findings, designers and educators teaching

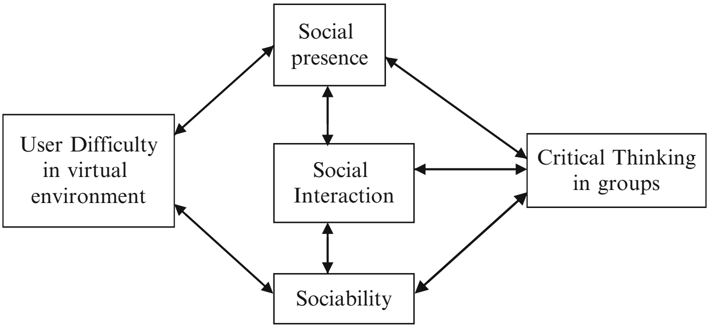

Fig. 1 Conceptual model showing relationships among user difficulty in virtual environments, social presence, sociability, social interaction, and critical thinking in groups during collaborative problem-solving activity in three types of virtual environments (e.g., text chat, audio conference, or avatar-based)

online courses should focus more on students' preferences and perceived level of difficulty in using different types of virtual environments instead of being driven by the various sophisticated features of these environments. Moreover, the nature of the collaborative task given in the study also influenced students' perceptions of difficulty in using the environment assigned to them. The participants of this study felt that the avatar-based environment was too sophisticated and unnecessary for the simple collaborative activity they were required to complete and thus, they preferred the simplicity of text chat over Second life. Some of the comments of the students in the open ended question stating this preference were "Second Life is way overdone for simple collaboration," and "I do not think that virtual avatars are necessary."

Also, most of the participants found audio conferencing difficult to use for completing the simple collaborative activity of this study. Some of the comments expressing their difficulty were, "Although it was a little like a phone conversation, it was more difficult since it was with multiple people and I didn't want to end up talking over other people too much," "I think it is effective but something you have to get used to using, for example volume, pushing buttons at the same time, and speaking clearly." Thus, the facility of audio conversation was not perceived favorably because the participants were apprehensive of interrupting others, unlike in text chat where they could type their comments and arguments without cutting each other out. Furthermore, as the collaborative activity required students to remember each other's comments regarding ranking action steps given to them, text chat allowed them to scroll up the chat window and refer to their team members' comment, unlike in audio conferencing where they had to rely solely on their memory. Thus, future researchers should examine whether different types of collaborative activities (e.g., simple vs. complex, tasks that do not require memorizing vs. tasks that require memorizing) influence students' or users' preferences for a particular type of virtual environment as a collaborative tool.

Finally, the scale developed to measure critical thinking in groups needs to be further validated in similar studies conducted with different samples. This study made an effort to explore the associations of critical thinking in groups with social presence, sociability, and social interaction across different types of virtual environments. Similar studies would help to further verify and extend the findings of this study.

Limitations

One possible limitation of the study is that the sample of the study was drawn from a younger population of college going students. The results might not be generalizable to an elder group of professionals who might have more exposure to the different virtual environments used in the study, but might lack the tech savvy quality of the younger generation.

Another possible limitation of the study is that the participants of the study were taken from a face to face class and hence these participants were familiar with each other prior to the study. Such familiarity may imply that the participants had already developed relationships with each other offline and this offline camaraderie influenced their perceptions of social presence, sociability, and social interaction in the online collaborative activity used in this study. However, it should be noted that the participants were divided into groups and the group compositions were made to ensure that the groups comprised of individuals who had never worked with each other in a team in their face-to-face class.

Conclusion

Nature of collaborative activity and user difficulty are factors that are often considered less important while making decisions about which type of virtual environments should be used in collaborative class exercises that are common in online courses. This study cautions against such oversight and guides educators to wisely use complex online technologies by advocating a renewed focus on factors over and beyond the level of sophistication of these technologies. In doing so, this exploratory study informs online course designs that support critical thinking and teamwork in various content areas.

Appendix

Scale of Critical Thinking in Groups

1. My team clearly understood the purpose of the problem-solving activity.
2. My team clearly understood the situation and the challenge.

3. Given the information, my team was able to perform the team ranking.
4. My team clearly understood the key concepts in the challenge.
5. My team interacted to clarify any assumptions.
6. My team developed a clear line of reasoning to explain team rankings.
7. My team was aware of everyone's points of view.
8. My team clearly understood the implications of the team ranking.

References

Bednar, A., Cunningham, D., Duffy, T., & Perry, J. (1995). Theory into practice: How do we link? In T. Duffy & D. Jonassen (Eds.), *Constructivism and the technology of instruction* (pp. 17–35). Hillsdale: Lawrence Erlbaum.

Brown, G., & Yule, G. (1983). *Discourse analysis*. New York: Cambridge University Press.

Burgoon, K., & Hale, L. (1987). Validation and measurement of the fundamental themes of relational communication. *Communication Monographs, 54*, 19–41.

Clark, R., & Mayer, R. (2003). *E-learning and the science of instruction*. San Francisco: Jossey Bass.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale: Erlbaum.

Daft, R. L., & Lengel, R. (1986). Organizational information requirements, media richness, and structural design. *Management Science, 32*, 554–571.

Garrison, D. R., & Anderson, T. (2003). *E-learning in the 21st century: A framework for research and practice*. London: Routledge Falmer.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical thinking in a text-based environment: Computer conferencing in higher education. *Internet and Higher Education, 11*(2), 1–14.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education, 15*(1), 7–23.

Gunawardena, C. N. (1995). Social presence theory and implications for interaction and collaborative learning in computer conferences. *International Journal of Educational Telecommunications, 1*(2/3), 147–166.

Hampel, R., & Hauck, M. (2004). Toward an effective use of audio conferencing in distance language courses. *Language, Learning and Technology, 8*(1), 66–82.

Hare, A. P., & Davis, M. F. (1994). Social interaction. In A. P. Har, H. H. Blumberg, M. F. Davies, & V. Kent (Eds.), *Small group research: A handbook* (pp. 169–193). Norwood: Ablex.

Hiltz, S. R. (1994). *The virtual classroom: Learning without limits via computer networks*. Norwood: Albex.

Human Synergistics Survival Series (2007) Retrieved from http://www.humansynergistics.com/products/survival.aspx.

Johnson, D. W., & Johnson, R. T. (1999). *Learning together and alone: Cooperative, competitive, and individualistic learning*. Needham Heights: Allyn and Bacon.

Krejins, K., Kirschner, P. A., & Jochems, W. (2003). Identifying the pitfalls for social interaction in computer-supported collaborative learning environments: A review of the research. *Computers in Human Behavior, 19*, 335–353.

Krejins, K., Kirschner, P. A., Jochems, W., & van Buuren, H. (2004). Measuring perceived quality of social space in distributed learning groups. *Computers in Human Behavior, 20*, 607–632.

Krejins, K., Kirschner, P. A., Jochems, W., & van Buuren, H. (2007). Measuring perceived sociability of computer-supported collaborative learning environments. *Computers & Education, 49*, 176–192.

Liaw, S., & Huang, H. (2000). Enhancing interactivity in web-based instruction: A review of the literature. *Educational Technology, 40*(3), 41–45.

Lin, G. (2006). *Social presence questionnaire of online collaborative learning: Development and validity.* Chicago: Association for Educational Communications and Technology. ERIC Document Reproduction Service No. ED. ED 484999.

Mansour, S., Rude-Parkins, C., & El-Said, M. (2006). The effect of the type of communication medium on learners' perception of social interaction in e-learning. Presentation at AACE Conference, Orlando, FL. Received the highest reviewer scores and invited for publication in AACE journal.

Matsuura, N., Fujino, G., Okada, K., & Matsushita, Y. (1993). An approach to encounters and interaction in a virtual environment. *Proceedings of ACM Computer Science Conference* (pp. 298–303). Association for Computing Machinery.

Mehrabian, A. (1969). Some referents and measures of non-verbal behavior. *Behavior Research Methods and Instrumentation, 1*(6), 205–207.

Northrup, P. (2001). A framework for designing interactivity in web-based instruction. *Educational Technology, 41*(2), 31–39.

O'Neill, J., & Martin, D. (2003). *Text chat in action.* Paper presented at the ACM Conference on Groupware (GROUP 2003), Sanibel Island, FL.

Paul, R., & Elder, D. (2003). The miniature guide to critical thinking concepts & tools. The Foundation for Critical Thinking.

Salinas, E. (2005). Effects of communication mode on social presence, virtual presence, and performance in collaborative virtual environments. *Presence, 14*(4), 434–449.

Schroeder, R. (2002). *The social life of avatars*. London: Springer.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. London: Wiley.

Tabachnick, B. G., & Fidell, L. S. (2001). Using multivariate statistics (5th ed.). New York: HarperCollins.

Tu, C. (2002). The measurement of social presence in an online learning environment. *International Journal of E-Learning, 1*(2), 34–45.

Whittaker, S., & O'Conaill, B. (1997). The role of vision in face-to face and mediated communication. In E. E. Finn, A. J. Sellen, & S. B. Wilbur (Eds.), *Video-mediated communication* (pp. 23–50). Mahwah: Erlbaum.

Needs Assessment: Developing an Effective Online P-6 Engineering Professional Development Program

Wei Liu, Ronald L. Carr, and Johannes Strobel

In an era of school reform, many consider the professional development of teachers to be the cornerstone of educational improvement. Bruner (1960) argued that children are ready to learn when teachers are ready to teach. The National Commission on Teaching and America's Future (1996) reported, "What teachers know and do is the most important influence on what students learn (p. 6)." At its root, achieving high levels of student understanding requires greatly skilled teachers and schools that are organized to support teachers' continuous learning.

The Institute for P-12 Engineering Research and Learning (INSPIRE) at a Midwestern Research I university was established in 2006 to develop and maintain strong partnerships with educational constituents to build a vital and consistent platform for research and translation of results of engineering into formal classroom implementation. INSPIRE provides elementary teachers with professional development in engineering education through week-long, face-to-face summer academies and an online professional development program. This project's concept of "teacher professional development" involves knowledge and appreciation of engineering; identification of different engineering disciplines; integration of engineering with science, math, and literacy; application of the engineering design process; aware-

W. Liu, M.S (✉)
Purdue University, Grissom Hall, 360E, 315 North Grant Street,
47907, West Lafayette, IN, USA
e-mail: liu31@purdue.edu

R.L. Carr, M.S
P-12 Engineering Education Research Fellow, INSPIRE Doctoral Student,
Learning Design & Technology Grissom Hall, 360E Purdue University 315 North Grant Street,
West Lafayette, IN 47907, USA

J. Strobel, Ph.D
Director, INSPIRE Institute for P-12 Engineering Research and Learning Assistant Professor,
Learning Design & Technology, and Engineering Education Grissom Hall,
360B Purdue University 315 North Grant Street,
West Lafayette, IN 47907, USA

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ness of resources (including digital resources) for the classroom; dedication to their own inquiry and continued professional development; heightened confidence in the uses of instructional technology; and fundamental sense of wonder and passion for engineering that will inspire students.

Online Teacher Professional Development

Online learning environments are rapidly emerging across various sectors of society (Dede 2006). In education, opportunities to access a wide range of courses and professional development services are now available on the Internet. In recent years, cyber-enabled professional development has expanded rapidly throughout higher education, corporate training, and the P-12 arena. Organizations and institutions are offering an increasing number of cyber-enabled professional development opportunities to P-12 educators (see Dede 2006 for many state-of-the-art examples of online teacher professional development).

Because finding time and resources for P-12 educators can be challenging, cyber-enabled instruction offers a convenient, accessible, and often inexpensive method for updating pedagogical expertise. It also provides opportunities to build a long-term plan for development of teachers' pedagogical and content skills in an educational environment that, unlike short-term workshops, provides ongoing learning, mentoring, and networking opportunities (Barab et al. 2004).

Yet, online learning environments are still new, and principles for the design of this environment are just emerging (Duffy and Kirkley 2004). In particular, supporting practicing professionals in a "learning anytime, anywhere" environment can be quite challenging. However, it is the design of these types of environments that hold unique opportunities for enabling P-12 teachers to seek convenient but high-quality professional development opportunities to help them meet personal and professional goals.

Our program is innovative, yet the innovation seems different from other educational innovations. While reported research has focused on innovations in regard to specific technologies (e.g., videoconferencing), curriculum (e.g., new structure), or pedagogical approaches (e.g., scientific inquiry), the project presented here focuses on a different class of innovation, a quadruple innovation, namely, the combination of (1) the introduction of a new content area, which is mostly unfamiliar to teachers (e.g., engineering); (2) the relationship with other content (math and science or literacy) is actively negotiated and the new content changes other content substantively; (3) the engineering design cycle, model-eliciting activities, and optimization are considered new pedagogical approaches, which teachers utilize in other curricula; and (4) engineering processes can be considered for reforming school systems.

In order to support professional development to teachers, it is necessary that the innovative features of the project and the need for professional development are assessed and developed together, particularly once the program extends from a week-long face-to-face workshop into a cyber-enabled component.

Needs Assessment

A needs assessment is the process of collecting information about an expressed or implied organizational need that could be met by conducting training or nontraining support. The need can be a desire to improve current performance or to correct a deficiency (Gupta et al. 2007). The success of an online education experience depends primarily on the program design that is based on sound instructional design theory and principles (Marks et al. 2005; McGorry 2003). Establishing user and program needs and requirements is the driving force behind design decisions (Sharp et al. 2007). Therefore, it is of particular importance that a thorough needs analysis be conducted in order to improve and sustain the success of an online program design.

There are different types of needs assessment. One type of needs assessment could identify a gap between the desired and future state, while another type of needs analysis could examine why the gap exists (Stewart and Cuffman 1998). Other types of needs assessments exist such as conducting a goal analysis, performance assessment, or context analysis (Gupta et al. 2007; Morrison et al. 2007). After initial learner and contextual needs have been identified and a design has been proposed, the design team should also consider new needs that may arise in light of the design that is initially proposed, such as computer hardware or technology training needs.

Purpose of the Study

This study was designed to identify and prioritize the development needs of the online P-6 pioneering engineering education teacher professional development program. Since little is known about engineering teachers' beliefs and expectations in the online teacher professional development regarding engineering support, this mixed methods approach to inquiry is expected to lend insight to the instructional designers and those who are considering or offering engineering-related online professional development. The research questions guiding our study included:

1. What features do the teachers expect to have in the online teacher professional development program intended to support the integration of engineering into their classrooms?
2. What design principles will promote the teachers' collegiality and collaboration in the online community?

Theoretical Framework

From Vygotsky's social constructivist perspective, the sociocultural context influences the thinking and creation of meaning. The process of formulating meaning consists of negotiation among participants through dialogues or conversations. The opportunity to interact with other learners in sharing, constructing, and negotiating meaning leads to knowledge construction. Within a constructivist model, learning is based on constructing meaning from experience and interpreting the world largely through the social processes (Jonassen 2000).

Communities of practice are viewed as emergent, self-reproducing, and evolving entities, which are distinct from, and frequently extend beyond, formal organizational structures with their own organizing structures, norms of behavior communication channels, and history (Wenger 1998). Members often come from multiple organizations drawn to one another for both social and professional reasons. Newcomers gain access to the community's professional knowledge tools and social norms through peripheral participation in authentic activities with other members (Schlager and Fusco 2004). Therefore, the constructivist framework with a focus on the situated and social nature of learning was used as theoretical framework in the study on our teacher professional development.

A central theme underlying many of the current attempts to promote teacher development has been the notion that collaboration and collegiality contributes to teacher growth (Harris and Anthony 2001). Lysenko and Strobel (2006) defined collaboration as teachers' joint cooperation with others such as working together on integrated units or creating grade-level curriculum. Collegiality is teachers communicating, relating, and sharing with colleagues or peers such as casual conversations with other teachers in the hall, teacher's lounge, or outside of school by other synchronous and asynchronous communication tools. Teachers' social interaction as trust, value, etc. has been adequately taken into account by the designers for this virtual community.

Method

Overview

A mixed methods approach was used to explore the needs and design principles of our online P-6 pioneering engineering education teacher professional development program. The mixed methods approach is defined as the type of research in which "…a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration" (Johnson et al. 2007, p. 123). By using the two approaches to data collection and analysis, Creswell (2007) said that researchers could gain a more robust understanding of the research by triangulating qualitative data gathered through interviews with the data gathered through the survey.

Role of Researchers

This study was designed and implemented by a research group in INSPIRE at a large Midwestern university. The group consisted of one professor in both educational technology and engineering education and two graduate students in educational technology. As a group, we worked to define the research protocol, apply for human subject approval, modify specific data collection procedures, and analyze and interpret data we collected. Working in a group helped to reduce the personal biases that each individual researcher might have brought into the study.

Instrumentation

Throughout our project, P-6 teachers are expected to "cross the chasm" by the following criteria: teachers should be able to (without prompt or support):

- Describe the components of the engineering design cycle
- Evaluate appropriate segments in their existing lesson plans to integrate engineering
- Apply their understanding of engineering to the development of lesson plans based on the engineering design cycle and engineering constraints
- Design lesson plans to include engineering components
- Implement engineering elements into their classrooms
- Integrate engineering thinking (including design, constrains, systematic testing, purpose, development for clients) into their existing lesson plans and with STM content
- Estimate/hypothesize difficulties of students to understand and apply engineering thinking during their lesson
- Design assessment plans for their students to measure their progression in developing engineering thinking/skills
- Assess their students' progression toward engineering knowledge (about/how to)
- Compare/contrast the effectiveness of different strategies to teach engineering concepts and skills
- Adjust and justify changes to the lessons based on assessment results

According to the above goal, researchers developed a survey with 34 items. Thirty one were multiple-choice questions. Three were open-ended questions. The following categories were addressed in the survey: demographic information, general impression of online community, perception and prioritization of the needs of online community, and perception of the participation. The survey questions consisted of close-ended Likert scale questions. The participants were asked to select the option corresponding to the response that best described how strongly they disagree or agree with the statement. Rankings were (0 = irrelevant, 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). As for ranking questions, a number between 1 and 7 next to each item is selected. 1 is the most likely factor to encourage or discourage participation, and 7 is the least likely factor.

The follow-up semistructured interview was designed to capture the participants' perceptions of the online program. Interviews were conducted after the survey. The goal of the interview was for teachers to discuss their thoughts relating to the perception and prioritization of the needs of online community and perception of the participation. The research team triangulated the data in order to develop the effective design principles that emerged from the discussions.

Table 1 Demographic characteristics of teacher participants

	Gender		Region						
N	Female	Male	Indiana	Texas	New Mexico	Florida	Colorado	Maryland	Michigan
110	92	18	27	60	4	10	2	3	4

Research Procedure

Since INSPIRE started the face-to-face academies in 2006, a total of 296 teachers around the country attended the workshop. Between July and September in 2009, 110 teachers (37%) responded to the survey for our online teacher professional development community for engineering in elementary schools (see demographics in Table 1).

In the following 2 months, researchers interviewed 20 of the initial respondents who volunteered to participate in follow-up interviews. The second round of data collection focused on having more in-depth information to illuminate the questions under study. To ensure participant confidentiality and anonymity, pseudonyms are used throughout.

Data Analysis

The descriptive data for each scale of the instrument survey were calculated. The interviews were recorded and transcribed. Once all of the survey's open-ended questions and interviews were completed, the researchers open-coded all of the data, discussed the findings with each other, and searched for additional patterns through cross-interview analysis to identify suggested features for the online teacher professional development program. At this step, the researchers completed the axial coding phase of the research project.

Validity and Reliability

Triangulation of multiple resources increased the credibility and validity of the results. Researchers collected demographic information, surveys, and interviews. Throughout the study, maintaining contact with the participants helped researchers with consistency of data collection and interpretation of the data. Data analysis involved individual and collective efforts which led to reliability of the results.

Results and Discussion

The survey results showed that there was a perceived need and willingness to participate in an online community for teachers in INSPIRE (Figs. 1 and 2). In open-ended response, Susan desired "continual access to new information and a forum to keep the momentum going to sustain the INSPIRE effort in our school." Courtney wrote, "I would like to be able to ask someone about specific questions that I may not feel comfortable about." Similarly, Daniel noted the ability to share reflections

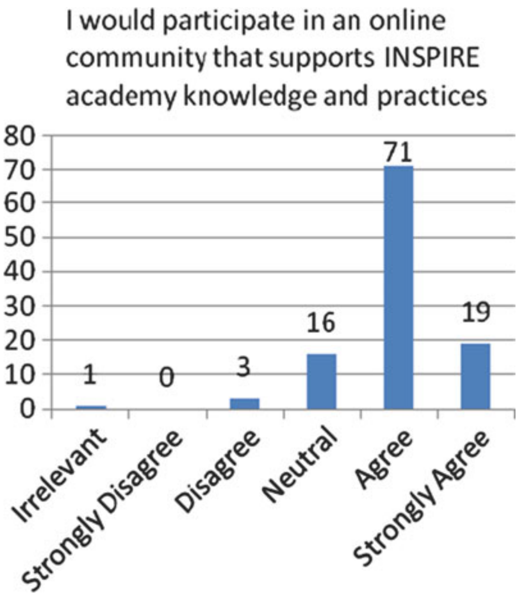


Fig. 1 Participation Interest (N = 110)

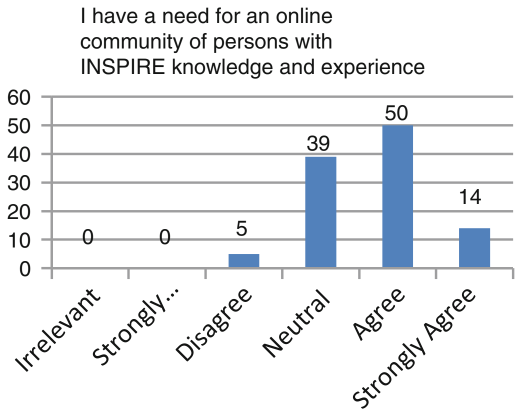


Fig. 2 Need for Community (N = 108)

with other teachers as important, "I would like to know what worked and what did not. How were the activities adapted in order to fit a certain grade level?"

Features the Teachers Expect to Have in the Online Teacher Professional Development

Access to resources such as implementation guides and new activities was ranked as the primary factor that would encourage participation followed by collaboration with other INSPIRE teachers and support from INSPIRE staff (Fig. 3). In fact, interviewees

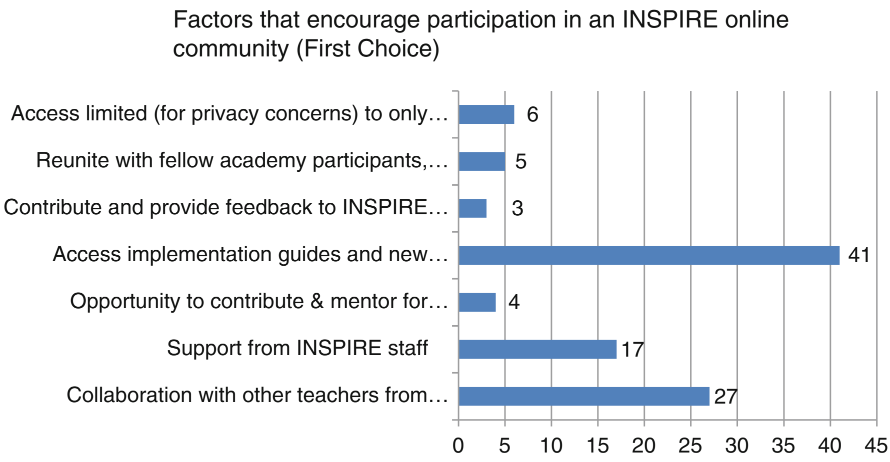


Fig. 3 Factors that encourage participation (N = 103)

went on to indicate that participation in innovation through design of new materials, lessons, and programs would be one benefit of online collaboration that was not mentioned in the survey. “I’d like to swap stories of how we’ve integrated engineering in our classrooms, see how previous years’ attendees have created new engineering activities for their classrooms, and obtain feedback on my feeble efforts to create my own engineering materials,” noted Janice, a respondent that noted isolation as a motivator for accessing online means of collaboration. Marsha told of an instance of online collaboration, “I communicated with … about the way I was integrating engineering with critical writing and reading instruction through an economics lesson set.” Another teacher told of participating in innovations through online collaboration with a teacher from another school that also includes collegial experiences, “We’ve developed several study units together, received joint grants, went on several joint voluntary field trips, and arranged joint family nights.”

The teachers were asked to further identify specific features that they would be interested in by indicating their interest level in each. Obtaining new materials and knowledge refreshment were indicated to have the highest level of interest (Fig. 4).

The qualitative results also showed that teachers wanted content-related materials. Amanda expected to “continually increase my knowledge about engineering as well as improve and get new lessons.” Access to curriculum units, implementation guide, supplementary lessons, video cases, lesson plans, worksheets, knowledge-based assessments, and teacher self-debriefing were rated as highly necessary.

The above features could prepare the teachers to become competent in the content they will teach and understand pedagogical practices. What’s more, as Darling-Hammond and Bransford (2005) mentioned, the teachers needed to “learn how to teach within the complex environments in which they will work. Thus, in addition to helping teachers gain general understandings of content and pedagogy, effective teacher preparation programs must also prepare and support teachers as they learn to work in complex environments.” The design principles that emerged from our

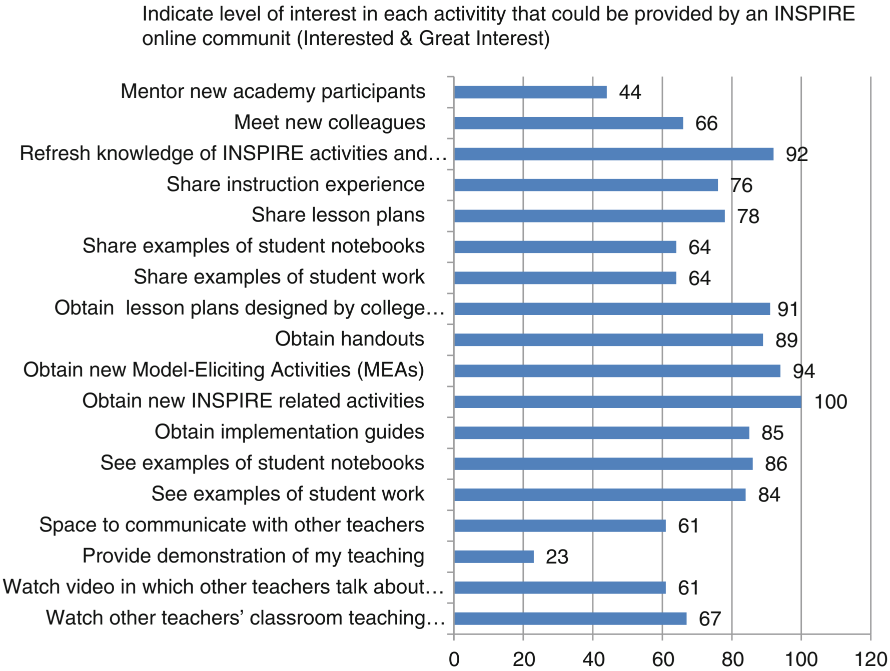


Fig. 4 Activities of interest (N = 110)

survey data, and interviews could promote the teachers' collegiality and collaboration in the online teacher professional development under the time constraint.

Design Principles to Facilitate the Teachers' Collegiality and Collaboration

Green and Cifuentes (2008) said that "the greatest challenge to providing follow-up to professional development is simply finding time in a teacher's day. Time for teacher learning is an elusive commodity in American schools. Teachers' days are filled with countless tasks leaving little time to think about, much less plan for innovation." Similarly, the teachers, who participated in our study, ranked factors that would discourage their participation in an online teacher community for INSPIRE. The participants indicated time and lack of support as primary factors that would discourage participation (Fig. 5). One response promoted the importance of asynchronous communications present in online communities, "It is a time factor," he noted when discussing the convenience being able to increase his collaboration opportunities. "I could do it on my own schedule."

Some teachers expressed time needs as an important factor by noting previous experiences with online communities that had little to no participation. One teacher mentioned an e-mail Listserv that began as very active and productive but eventu-

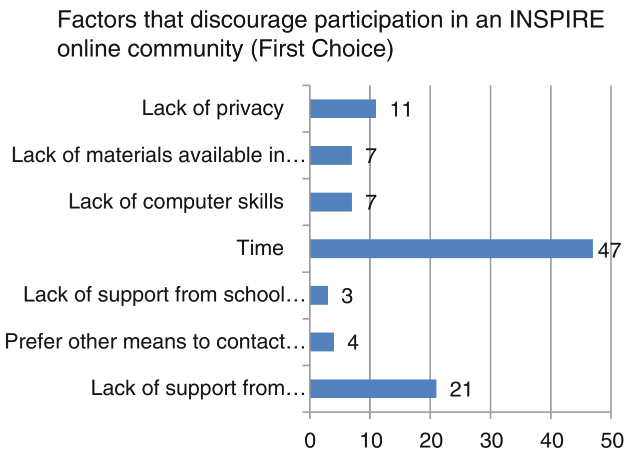


Fig. 5 Factors that discourage participation (N = 100)

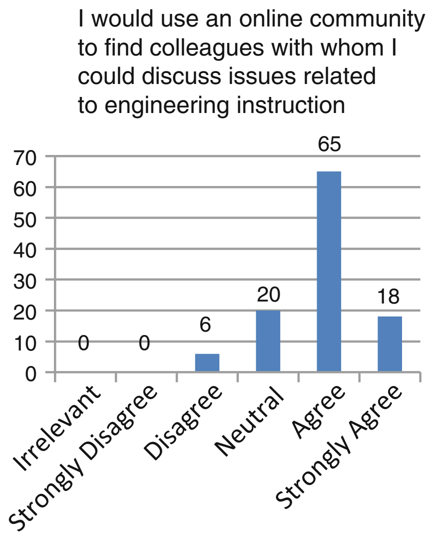


Fig. 6 Collegial discussion (N = 110)

ally "died out" due to a lack of participation and addition of new members. Another teacher expressed hope for a growing online community for engineering teacher professional development, "The more people who are involved the bigger impact is likely to be made." The annual addition of more teachers through new cohorts and expanding into new states and school districts could help out community to meet this need.

Even though teachers expressed concerns about time, the survey respondents indicated that they would use the community for collegial and collaborative purposes (Figs. 6 and 7). Input and participation from staff representatives from

Fig. 7 Collaborative intent (N = 109)

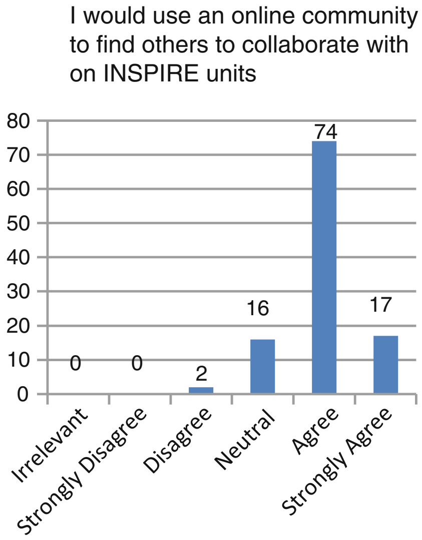
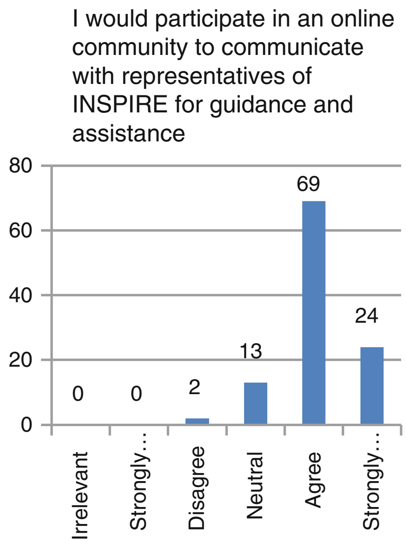


Fig. 8 Expert guidance (N = 108)



INSPIRE were also needed (Fig. 8). The qualitative data also showed that the teachers did spend time gaining support from peers through face-to-face contact or e-mail. Heather said that "As a grade-level team we plan together and talk about ideas for implementing." Kimberly mentioned that "I have spoken to the other teachers in my building who attended the academy about what part each of us would use in our individual classrooms." Because engineering is an integrative unit, teachers also collaborated with each other "regarding to lesson planning and expectations that need to be met in fourth grade. We also help each other with paper work that constantly has to be turned in and try to keep a scope and sequence of science units

(Mary).” Other teachers also noted the need for collaboration to discuss meeting the needs of the scope and sequence as well as aligning the instruction with their state standards and solutions for assessing and grading the new curriculum.

Another teacher, Melanie, an eager contributor to both face-to-face and online collaboration notes, “…and I always collaborate and use each other as a sounding board. It makes the whole lesson more positive for us and the kids—a lot less stressful. The third grade teachers coming in were excited after seeing my tech lesson. They felt more comfortable and ready to do it with their kids.” Other teachers without current online access or limited access indicated the need for an online community to participate in by expressing suggestions for other teachers or requests for assistance through the interview. One teacher provided the following advice: “I think that one of the best things is that students are recognizing that they have to step outside of their own perceptions and see from others’ points of views.” While another noted, “After doing a lesson with my students the puzzles pieces fall into place and makes me want to learn more and work with others.” Similarly, two teachers expressed the need to hear from other teachers in order to see examples of other students’ work including concept maps, pictures, and engineering design plans.

Therefore, designers build trust for the teachers at first in the summer academy. Face-to-face opportunity for teachers to meet each other which builds some level of trust in summer academy is a good start to form our online community for newcomers. Members of the group shape learning agenda together. Teachers are provided opportunities to collaborate on small activities in the community. Teachers are introduced to Facebook, and they add each other and talk as a group. Photos taken during academy are posted voluntarily as well. Teachers make lesson plans and share by using Google Docs. It is a free, Web-based word processor, spreadsheet, presentation, and form application offered by Google which allows users to create, edit, and deposit documents online while collaborating in real-time with other users. After teaching, teachers also write down their reflections and share with each other in Google Docs. Then, we create a dedicated online space for teachers’ interaction for content and noncontent specific discussions. One participating school district also facilitates online INSPIRE meetings for synchronous discussions between teachers that includes corporate facilitators and an INSPIRE teacher in residence.

By placing videoconferencing capabilities in classrooms, INSPIRE can provide teachers with feedback after classes they teach, thus supporting the teachers in their context with context-specific and tailored feedback. Reflective video cases are embedded in the online community as well. By utilizing saved videos of classroom instruction, real classroom practice becomes the anchor for professional development, in the summer academies or in sessions delivered online over an extended period of time. Last but not least, teachers can invite other teachers to watch their performance and collaborate with each other. Lily commented that “My collegial communications with teachers online is through e-mail and typically very casual. They have all been positive.” Natasha wishes, “I would like it to be a place where we can share ideas, experiences from teaching lessons and share lesson plans we create.” Since many of our teachers are geographically separated, the videoconferencing can provide teachers with efficient and low-threshold means to collegiate and collaborate with other teachers.

Therefore, our online professional development program could tailor to teachers' busy schedule that provides work-embedded support. By creating additional and more flexible delivery models and design principles, online teacher professional development could be in a better position to support interventions that are significantly embedded in professional development.

Limitation

Our survey did not require teachers to fill in every item to move forward to the next page. Therefore, some participants missed 1–2 items which resulted in various numbers of responses per item. A random sampling of 20 of the 110 responders was invited to participate in follow-up interviews. Only eight of those responded, and finally, two finished the interview. Therefore, we had to ask the rest of the survey participants for follow-up interviews, and we got other 18 participants. The convenient sampling might have some biases.

The response rate to the survey was 37% which was not high. Options for participation were given to the educators to fit their busy schedule. We provided e-mail, phone, or mail options to participate. Similarly, time for conducting the study was considered as well. Usually, it was hard to reach all the teachers during the summer holiday. In middle and late August, teachers were usually very busy preparing for the new semester.

Conclusion

Our teacher professional development offers a dual approach of face-to-face summer academy and cyber-enabled performance support. This dual approach ensures that teachers are supported beyond an initial workshop and receive feedback and training in the time of need in their school and classroom context and allows for an extensive amount of contact time between INSPIRE staff and the teachers throughout the year.

The cyber-enabled component enables the year-round development of an online community for participating teachers and in-time and on-site support. The individual performance support could be achieved onsite, from feedback in time of need via online communities and videoconferencing. A sustained process to help teachers implement and integrate the curriculum they actively learned in their summer academy into their classes is assured. Additionally the year-round support infrastructure and the video collected in the teachers' classrooms could also allow a unique ability to assess the immediate impact of our online teacher professional development (oTPD) in the classroom.

References

Barab, S., Kling, R., & Gray, J. (2004). *Designing for virtual communities in the service of learning*. New York: Cambridge University Press.

Bruner, J. S. (1960). *The process of education*. Cambridge: Harvard University Press National.

Creswell, J. W. (2007). *Designing mixed methods research*. Thousand Oaks: Sage Publications.

Darling-Hammond, L., & Bransford, J. D. (Eds.). (2005). *Preparing teachers for a changing world: What teachers should learn and be able to do*. San Francisco: Jossey-Bass.

Dede, C. (Ed.). (2006). *Online professional development for teachers: Emerging models and methods*. Cambridge: Harvard Education Press.

Duffy, T., & Kirkley, J. (2004). *Learner centered theory and practice in distance education*. Mahwah: Lawrence Erlbaum.

Green, M., & Cifuentes, L. (2008). An exploration of online environments supporting follow-up to face-to-face professional development. *Journal of Technology and Teacher Education, 16*(3), 283–306.

Gupta, K., Sleezer, C., & Russ-Eft, D. F. (2007). *A practical guide to needs assessments*. San Francisco: Pfeiffer.

Harris, D. L., & Anthony, H. M. (2001). Collegiality and its role in teacher development: Perspectives from veteran and novice teachers. *Teacher Development, 5*(3), 371–390.

Johannes Strobel Director, INSPIRE Institute for P-12 Engineering Research and Learning Assistant Professor, Learning Design & Technology, and Engineering Education Grissom Hall, 360B Purdue University 315 North Grant Street West Lafayette, IN 47907.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research, 1*(2), 112–133.

Jonassen, D. H. (2000). Toward a design theory of problem solving. *Educational Technology: Research & Development, 48*(4), 63–85.

Lysenko, L., & Strobel, J. (2006). Collaboration of teachers considered: An argument for collegiality-oriented professional development. Unpublished manuscript.

Marks, R. B., Sibley, S. D., & Arbaugh, J. B. (2005). A structural equation model of predictors for effective online learning. *Journal of Management Education, 29*(4), 531–563.

McGorry, S. Y. (2003). Measuring quality in online programs. *The Internet and Higher Education, 6*(2), 159–177.

Morrison, G. R., Ross, S. M., Kemp, J. E., & Kalman, H. K. (2007). Learner and contextual analysis. In Designing effective instruction (5th ed.). Hoboken, NJ: John Wiley & Sons.

National Commission on Teaching and America's Future. (1996). *What matters most: Teaching for America's future*. New York: National Commission on Teaching and America's Future.

Ronald L. Carr P-12 Engineering Education Research Fellow, INSPIRE Doctoral Student, Learning Design & Technology Grissom Hall, 360E Purdue University 315 North Grant Street West Lafayette, IN 47907.

Schlager, M. S., & Fusco, J. (2004). Teacher professional development, technology, and communities of practice: Are we putting the cart before the horse? In S. Barab, R. Kling, & J. Gray (Eds.), *Designing virtual communities in the service of learning*. Cambridge: Cambridge University Press.

Sharp, H., Rogers, Y., & Preece, J. (2007). *Interaction design: Beyond human computer interaction* (2nd ed.). Wiley: New York.

Stewart, R. G., & Cuffman, D. M. (1998). *Needs assessment: A systematic approach for successful distance education.* Retrieved May 2, 2010, from http://www.mtsu.edu/~itconf/proceed98/rstewart.html.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge: Cambridge University Press.

Wei Liu P-12 Engineering Education Research Assistant, INSPIRE Doctoral Student, Learning Design & Technology Grissom Hall, 360EPurdue University315 North Grant Street West Lafayette, IN 47907.

Why INSPIRE. Retrieved May 2, 2010, from https://engineering.purdue.edu/INSPIRE/AboutUs/index.html.

Higher Education and Postindustrial Society: New Ideas About Teaching, Learning, and Technology

Martha Cleveland-Innes and D. Randy Garrison

Within the last few decades, pervasive technology and significant social and economic development have forever changed our society. Social and economic change has made it increasingly difficult for education to operate in insular ways; attention to changing demographics, global economies, and new social mores is required (Keller 2008). The reach of technology seems limitless and has changed distance and higher education institutions in "the way we organize ourselves, our policies, our culture, what faculty do, the way we work, and those we serve" (Ickenberry 2001, Forward). In the midst of these developments, online teaching and learning has emerged.

New development is now the reference point for updating the academy, indicating what influences are on the way or at the door step, and what is not or will not work because of these changes in context. According to Keller (2008), changes in values, finances, behavior, technology, and education "constitutes [sic] the most consequential set of changes in society since the late nineteenth century, when the nation went from a largely domestic, rural, agrarian mode of living to an industrial, international, and urban economy" (Preface xi). Information-based, technologically mediated, demand-driven economies affect sociocultural realities in such a way that education has no choice but to respond. "The changing context of education and the aggressive encroachment into this domain by the powerful forces of digital commerce make it impossible to ignore … This set of circumstances is going to force all academic enterprises to rethink their place and purpose not just in philosophical terms but in very pragmatic ways as well" (Beaudoin 2003, p. 520).

M. Cleveland-Innes, Ph.D (✉)
Centre for Distance Education, Athabasca University,
1 University Drive, Athabasca, AB, Canada, T9S 3A3
e-mail: martic@athabascau.ca

D.R. Garrison, Ed.D
The Teaching & Learning Centre, The University of Calgary, Biological Sciences Bldg,
Room 539B, 2500 University Drive N.W., Calgary, AB, Canada, T2N 1N4

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From this practical, pragmatic point of view, everything from leadership models to cost-effectiveness is under scrutiny in higher education. Teaching and learning must be considered as well and may be the most commonly considered aspect of educational change (Kanuka and Brooks 2010). This consideration has begun to be translated into research; new models for teaching and learning are just beginning to surface (Garrison and Vaughan 2008; Cleveland-Innes and Garrison 2010). Discussions about online learning as a central feature in changes to teaching and learning are many, but "despite the considerable, growing interest in online education, most studies have focused only on the students' perspective. Merely a handful of studies have attempted to address the teachers' perspectives, and little has been published on the online teaching experience itself" (Gudea 2008, inside cover).

Defined as Internet-based learning that delivers content and enables communication between and among instructor and students, online teaching and learning is rooted in advanced computer and communications technology. Absent from the developing field is a foundation of thought from the fields of distance, higher, and adult education; the technology has asserted itself before the implications on teaching and learning were clear (Shale 2010). Previous discussions on the topic of online learning pay little attention to this integration; what reference is available is superficial and separate from the premises of facilitating online learning. A new text edited by the authors (Cleveland-Innes and Garrison 2010) presents the conceptual and structural foundation for a new era in teaching and learning and the emergence of successful implementation of online learning. This chapter will draw from this text and reviews the place of online learning in relationship to new teaching and learning models.

Education, Society, and Online Learning

Changes in education are required when "neither the purpose, the methods, nor the population for whom education is intended today bear any resemblance to those on which formal education is historically based" (Pond 2003, n.p.). In fact, "our students have changed radically. Today's students are no longer the people our educational system was designed to teach" (Prensky 2001, p. 1). Never has our student body been more diverse. Content and delivery of education programs must now consider the needs of seniors, working adults, traditional age students, and increasing numbers of international participants. If online learning has emerged, at least in part, in reference to these needs, how must we shape teaching?

Online learning offers teaching and learning possibilities inconceivable in industrial distance and higher education. To consider this further, it can be viewed through the lens of distance education or through higher education broadly; however, differing pictures result. The current generation of distance education, online learning, is a response to postmodern, post-Fordist, socioeconomic environments. Distance education has moved from print-based, independent study to constructivist, collaborative learning through synchronous and asynchronous online classrooms. Here, underpinning online learning is the collaborative engagement of the learner, who assumes increasing responsibility for their learning, looks to the material and course design to facilitate learning, and sees the instructor not as a directive leader but a supportive facilitator. Such is online learning designed by those whose roots rest in distance education models.

Education models in traditional higher education have responded differently to the postindustrial turn. Mainstream higher education considered and adopted new learning technologies and blended learning environments with face-to-face, and online learning emerged. Missing is the reconceptualizing, restructuring, and reshaping of the teaching and learning transaction already a part of distance education. While good results about blended learning are coming in, the *how* question remains unanswered. According to the U.S. Department of Education (2009), students in online learning performed better than those receiving face-to-face instruction. Moreover, the "difference between student outcomes for online and face-to-face classes …was larger in those studies … that blended elements of online and face-to-face instruction than conditions taught entirely face-to-face" (p. ix). The reasons for this result are complex, consistent with the theoretical arguments for blending the best of face-to-face and online approaches (Garrison and Vaughan 2008). Extending such clear but complex models and answering the *how* question are central to our development of contemporary, relevant, and effective models of blended and online learning.

The "how" question cannot be answered without a thoughtful review of current and emerging teaching processes and roles for teachers. In our synthesis of innovative change in higher and distance education, we ask questions about these things. Current models of online learning and related components (Garrison et al. 2001; Twigg 2003) rest on varying and multiple assumptions, some from the past, some more current. For example, higher education is notable for the willingness to allow faculty the flexibility required of personal perspectives in the name of academic freedom, in both content decisions and pedagogical practice. Students, on the other hand, are treated to the same content and process, regardless of learning preferences, interests, or abilities. Online learning models vary in adherence to this process and may be rejected or adopted based on these and other hidden assumptions about the way teaching and learning should proceed.

In addition, we ask questions of practice. Have the collaborative possibilities of online learning changed the essence of the higher education process and experience? Are we seeing a convergence of distance and higher education through the mutual adoption of online learning theory and practice? In particular, we ask if we are to fully capitalize on the properties and potential of the Internet and communications technology to enhance the educational experience, then what principles and approaches consistent with both the ideals of a higher educational experience and the capabilities of new technologies need to be developed? These and other emerging questions point to a central issue that requires attention—*what should online teaching in higher education look like, and how do we facilitate the transition to new models of teaching?*

Teaching with Technology

To recap, technological advancement has a dramatic effect on everyday life and its many social institutions, from the workplace to entertainment. Higher education is not immune to these changes, but "the nature and scope of such changes is still contested" (Gumport and Chun 2005, p. 395). This is so for managing the infrastructure of the institution and for one of higher education's central mandates—teaching and learning. In the past 2 decades, higher education has, if not embraced new technology, reached out to utilize the Internet and other forms of technologically mediated learning. This has transformed interaction opportunities among students and between student and teacher, affecting both program management and the teaching-learning experience. This integration of technology has occurred in both traditional and distance learning institutions.

It appears that the technology asserted itself and became part of teaching and learning ahead of our understanding. More examination and research of this new opportunity is needed for careful consideration of the implications of technology on teaching. The first step in systematically exploring teaching and learning in online and blended learning environments is to consider the principles that may best support this new initiative—principles that are easily understood and serve as a guide for practice.

If we are to fully capitalize on the properties and potential of the Internet and communications technology to enhance the educational experience, we must develop principles consistent with the ideals of a higher education student experience *and* the capabilities of new technologies. These ideals are closely associated with creating and sustaining critical discourse and reflection (i.e., critical thinking) in collaborative communities of learners. It is at the intersection of traditional higher education at its best and the connective potential of modern communications technology that we find the realization of these ideals.

Early distance education models dealt with geographical constraints that used available technologies to increase access by bridging distance. This is in contrast with current, postindustrial considerations that reflect transactional issues and ubiquitous communication technologies (Garrison 2000; Kanuka and Brooks 2010). Thus, any discussion of teaching with technology requires consideration of multiple, complex phenomena and concepts. Originally, what we called distance education represents the activity between *individual* teachers and learners who are operating in an environment that has three special characteristics: separation from one another, material adapted to this reality, and *a set of special teaching and learning behaviors* (Moore 1991). It is in creating this set of special teaching behaviors that we propose a principled approach.

To help put the principles proposed here in context, we begin with a brief examination of the most prominent set of teaching and learning principles in higher education. These are the widely cited and adopted principles of good practice in undergraduate education published by Chickering and Gamson (1987).

The established principles of teaching in higher education, as outlined by Chickering and Gamson, require that such teaching:

- Encourages contact between students and faculty
- Develops reciprocity and cooperation among students
- Encourages active learning
- Provides prompt feedback
- Emphasizes time on task
- Communicates high expectations
- Respects diverse talents and ways of learning

The Chickering and Gamson principles were generated from research on teaching and learning and have guided educational practice in higher education over the last 2 decades. They were, however, based on traditional practice focused largely on the lecture; they were generated and intended for face-to-face environments. Moreover, they were formulated through consensus in a largely atheoretical manner. These principles are too often interpreted as a means to improve the lecture format when, instead, we should be rethinking about how we can better engage learners in more active and collaborative educational experiences. Establishing community and collaboration in learning requires that we go beyond passive lectures. In other words, when we add online experiences to face-to-face experiences, we must incorporate online learning techniques that have the potential to support and sustain community and collaboration. Most importantly, if we wish to sustain this transformation, these principles need to be embedded in a theoretical framework in order to provide coherence, direction, and explanatory power.

These principles have served higher education well in directing attention to good teaching and learning practice. However, we believe these principles need to be updated to address the changing needs in higher education and to become information literate in the age of the Internet. Established principles must be consistent with the ubiquitous connectivity afforded to students today. It is time to create a new set of principles that better reflect the ideals of a contemporary higher education experience, principles which recognize and utilize the capabilities of new and emerging information and communications technologies. While the established principles are not incongruent with online learning environments, there are conditions, assumptions, and properties of technologically mediated learning environments that must be considered and, with this, require revised and up-to-date principles of teaching.

Principles Supporting Online Teaching

The principles outlined below are a synthesis of three points of information. The first are the Chickering and Gamson (1987) principles outlined above. The second is the theory of an online community of inquiry proposed by Garrison et al. (2001) and researched extensively since that time (see www.communityofinquiry for a list of related research publications). The third is the recommendations made by various authors in our edited text on teaching (Cleveland-Innes and Garrison 2010):

1. Encourage collaborative, reciprocal, and cooperative contact among students and between students and faculty
2. Design learning activities for high engagement and active learning
3. Model and expect self-direction, responsibility, and timeliness
4. Encourage and support access to, and consideration of, multiple forms of information
5. Communicate clear objectives and high expectations
6. Respect competencies and diverse ways of learning
7. Foster open communication, affective expression, and group cohesion
8. Facilitate and reward inquiry that includes critical reflection, respectful debate, and movement toward resolution
9. Design for, encourage, and support the use of web-based collaborative learning applications
10. Ensure assessment is congruent with intended processes and outcomes

These principles are expanded briefly below.

1. Encourage collaborative, reciprocal, and cooperative contact among students and between students and faculty.
   New models of teaching and learning are based on inquiry models, with maximum exploration, review, and debate. This moves teaching out of presentation mode into the role of constructionist—or one who points to critical pieces of knowledge and examples to support central content objectives. Students participate as reviewers and provide perspective and critique, with the teacher and peers.
2. Design learning activities for high engagement and active learning.
   Student engagement is recognized as an important aspect of the learning experience (CCI Research Inc. 2009). Engagement is defined as: “The time and energy that students devote to educationally sound activities inside and outside of the classroom, and the policies and practices that institutions use to induce students to take part in these activities” (Kuh 2003, p. 25). Online and blended learning must enable and support this engagement and not detract from it.
3. Model and expect self-direction, responsibility, and timeliness.
   Chickering and Gamson (1987) speak of prompt feedback as a central example of pedagogically sound timeliness. We suggest that this type of teacher responsiveness is critical not only on assignments but also in all aspects of learning engagement. Specific to online learning, teacher immediacy is particularly important; “Students who perceived more frequent verbal and nonverbal immediacy behaviors in their teachers were more likely to give higher ratings to the overall quality of instruction and value of a course” (Richardson and Swan 2003, p. 78). In addition, students must be rewarded and encouraged to provide input and direction to the learning community. Direction can and should be provided at various times by the active participants in a community of inquiry.

4. Encourage and support access to, and consideration of, multiple forms of information.
   Problems of information overload aside, the Internet provides access to a vast amount of academic and scholarly information that should be considered and evaluated by students engaged in learning communities led by a teacher. "The growth of the WWW, then, provides educators with the opportunity, perhaps the imperative, to change their pedagogical focus from the transmission of knowledge to one enabling students to both make sense of an overabundance of information and use it to generate knowledge themselves" (Swan 2010, p. 111).
5. Communicate clear objectives and high expectations.
   Course goals and objectives should be clear, highly visible, and easily accessible. Clarification via presentation and discussion should be provided in the course introduction. The means to attain these objectives and available feedback opportunities should be provided early and regularly throughout the course. Contact by the instructor should reiterate required goals and objectives specified on the course web site in a nonthreatening and supportive manner (Newlin and Wang 2002).
6. Respect competencies and diverse ways of learning.
   The concept of ways of knowing is well established, and personalization of learning may be a hallmark of innovative learning environments (Twigg 2001). Although this may be very difficult to accomplish (Swan 2010), a commitment to understanding diversity in learning is the mark of new teaching. Individual students bring different talents and styles to class; differences occur across students and within students over time. Varied opportunities to engage in ways that generate learning and demonstrate competence for individuals must be included. From this foundation, new ways of learning, beyond what is currently most comfortable for an individual, may also be encouraged.

   Online instructors employing this principle "incorporated various ways to present course material, design assignments and format assessment within an 'open atmosphere' for learning … [indicating] … a genuine regard for the different learning styles of adult students and the 'democratization' of the online learning environment" (Grant and Thornton 2007, "Principle 7"). Used by effective online teachers, "technologies can help students learn in ways they find most effective and broaden their repertoires for learning. They can supply structure for students who need it and leave assignments more open-ended for students who don't. … Aided by technologies, students with similar motives and talents can work in cohort study groups without constraints of time and place" (Chickering and Ehrmann 1996, "7. Good Practice").
7. Foster open communication, affective expression, and group cohesion.
   The online course experience rests on the opportunity to communicate openly, express oneself with affect when necessary, and operate with a sense of group. This lays a foundation of social presence, a necessary but not sufficient condition for a sound community of inquiry. Care must be taken to encourage social interaction and provide structure and support early in the course (Garrison 2007; Swam 2002; and Swan et al. 2006). Facilitating discourse and reflection goes to

the heart of the process of inquiry. Facilitation, in this instance, means establishing the conditions where learners have the opportunity to share and think deeply about a subject.

Once the design of the educational experience has established objectives and activities, the first consideration in implementing these plans is to facilitate the creation of a climate where students feel comfortable to engage in critical discourse and reflection (i.e., social presence). This is largely accomplished by facilitating the creation of a sense of identity and belonging to the community. Through a shared sense of purpose and identity with the educational purpose, the necessary cohesion is created to collaboratively achieve the designed tasks and objectives.

8. Facilitate and reward inquiry that includes critical reflection, respectful debate, and movement toward resolution.
The primary purpose of inquiry is to support deep and meaningful learning experiences. A central task in designing for cognitive activity is to understand the inquiry process and foster appropriate phases of inquiry in a prescribed period of time.
Designing for integrated discourse and reflection requires appreciation of the different strengths of synchronous and asynchronous communication in relation to discourse or reflection, as needed. It is clear that fast-paced face-to-face communication may favor large amounts of interaction but does not provide the same opportunities for reflection found in online discussion boards. Well-structured learning activities supported by defined roles for teachers and students, and participation assessment that reflects the contribution required to engage in critical discourse, will improve the intensity of discourse and increase the likelihood of reaching resolution (Rourke and Kanuka 2007).
9. Design for, encourage, and support the use of web-based collaborative learning applications.
The success of any online learning environment depends upon the collaborative use of multiple sources of material—the engagement of free agents to electronically "browse the stacks" of web-based material that is content relevant. Knowledge construction develops in the use of this material—both individually in postings and blogs and collaboratively in group presentations, wikis, and social networking (Ice 2010).
10. Ensure assessment is congruent with intended processes and outcomes.
Although assessment is properly considered to be a direct measurement of knowledge acquisition and effort, this principle acknowledges assessment and its influence in shaping how students approach learning. To achieve deep and meaningful learning, it has been demonstrated conclusively that assessment must be congruent with the intended learning outcomes (Ramsden 2003). Assessment will strongly shape how students approach their learning. That is, if deep and meaningful learning is the intended outcome, then the quality of student learning outcomes *and* processes should be the basis of grades awarded. The need for a principle regarding assessment is found in research that demonstrates variation in approaches to learning based on assessment requirements (Entwistle 2000).

These principles conceptualize the increasing complexity that is part of teaching. We consider this complexity a major catalyst in the move toward inquiry-based learning; here, the support of inquiry becomes the dominant mode of teaching. Traditional delivery, usually lecture-based, provides multiple opportunities to enhance delivery (videos, PowerPoint, handouts, etc.) but functions primarily as a transmission model. The teaching role is one of course and material designer and presenter of information. If we contrast this conventional teaching to distance education, the mass production of self-directed learning materials was accompanied by a mediating and supportive teaching role. In this role, the teacher is no longer the designer or the deliverer but the mediator and examiner of learning. These two teaching roles were, in contrast to the collaborative nature of online and blended learning environments, relatively simple. The new role of teacher must include much of what has come before and must include the integration of multiple delivery modes and facilitation of learners constructively making sense of it all—including a wealth of resources they can, with guidance, find themselves.

Supporting the Transition to New Principles of Teaching

Changing Faculty Roles Increases the Need for Faculty Development and Support

Currently, faculty members serve as content experts, selecting disciplinary content that aligns with universal requirements. In addition, they set standards for learning outcomes and create assessment procedures to determine students' skill and knowledge. Unfortunately, most faculty members do so with limited knowledge of pedagogy, technology, or learning evaluation. This means that teaching and assessment strategies used by instructors vary widely. Based not on the art and science of teaching, teaching is based on personal preferences, the discipline and the epistemological position in which it is grounded, and models drawn for the reconstruction of past learning experiences. This will not suffice for the development of expert online instructors. Without direction and support from the institution, online teaching presence and quality are not systematic but sporadic. "The absence of a common basis for understanding and evaluating teaching makes it more difficult for members of the academy to agree on what good teaching is" (Zemsky et al. 2005, p. 125).

Constructivist Approaches to Teaching Will Become a Necessity

Information is growing exponentially. The proliferation of new information makes the job of teaching more dynamic and constructive than ever before. Information growth is a fundamental element in western industrialized societies; information's half-life has changed in ways we are only just beginning to understand. Once predicted to be doubling every 10 years, projections suggest information now doubles every 4 years (Aslanian 2001). Information involves the communication of knowledge or intelligence (Webster's Collegiate Dictionary 2002), as does teaching. This proliferation has increased demands on professors and administrators to keep content current, eating up resources already in short supply.

Instruction Must Become More Learner-Centered and Collaborative

Pedagogy, or the art and science of teaching, has been ostensibly absent from delivery models in higher education. To say a pedagogical shift is occurring within higher education is a misrepresentation. The best we can say is that since the inception of higher education institutions, knowledge has been transmitted to students. This transmission model is evaluated harshly in light of constructivist and metacognitive models of teaching and learning.

Embedded in this critique is the notion of greater consideration of the individual learner and his or her contribution to their own learning and the larger learning community. Applying learner-centeredness to teaching and learning models allows students to participate more fully in the arrangement of their own learning experiences. While the teacher is central to the experience, those teachers that empower their students are providing great benefit. For Chickering and Ehrmann (1996), students should become familiar with principles of teaching and learning "and be more assertive with respect to their own learning" ("Technology is Not Enough"). Curriculum objectives will expand to learning about processes, strategies, and methods, that is, "metalearning." Students will then be able to participate with instructors in the shaping of learning experiences that meet their needs as a learner. Individual education plans will emerge, plans created by the student in consultation with the teacher, rather than by the teacher in consultation with the student (Cleveland-Innes and Emes 2005).

The Role of Faculty as Teacher and Student as Learner Must Change

The students' view of their role as learner and that of the professor as teacher is different than the professor's view of the role of learner and his or her own role as the teacher. Role ambiguity exists systemically in higher education. In the transition to an online, learner-centered curriculum, roles for faculty and students should be agreed upon and explicit, embedding role clarity into a new curriculum delivery structure.

For the students, required behaviors, attitudes, and values as a participant in online higher education must translate into the role of independent, continuous, active learner. This role will emerge as an outcome of higher education curriculum as long as this curriculum includes the knowledge and skill required to support lifelong learning. In other words, higher education must accept the responsibility of developing individuals able to design and metacognitively manage their own learning.

For the faculty, the current role of teacher is highly variable across institutions, disciplines, and faculty members. In addition to well-developed content expertise, faculty must be well versed in the tenets of supporting learning in multiple, complex education environments. An adjustment to behaviors, attitudes, and values more considerate of students is required. For example, faculty will include strategies that foster deep rather than surface learning. In addition, faculty will support increased responsibility for students; the role will change to include guide and preceptor of the learning process.

Conclusion

Regardless of education delivery mode—face-to-face, online, distance, or some combination through blended learning—teaching (and learning) is changing. Online learning, whether synchronous or asynchronous, offers a range of pedagogical practices previously unavailable in both distance and face-to-face higher education. In turn, online learning offers the opportunity to examine and rethink the teaching and learning enterprise in education broadly. Online learning can be conceived of as the new distance education, where issues such as interaction and dialogue are introduced back into the distance education model (Evans and Nation 2003). Broader than interaction and dialogue, the new teaching model, online and otherwise, involves "adopting a set of assumptions and practices congruent with the ideal of a community of inquiry found in the mainstream of higher education" (Garrison and Cleveland-Innes 2010, p. 19).

References

Aslanian, C. B. (2001). *Adult students today*. New York: The College Board.

Beaudoin, M. F. (2003). Distance education leadership: An appraisal of research and practice. In M. G. Moore & W. G. Anderson (Eds.), *Handbook of distance education* (pp. 519–530). Mahwah: Lawrence Erlbaum Associates.

CCI Research Inc. (2009). *Measures of student engagement in postsecondary education: Theoretical basis and applicability to Ontario's colleges*. Toronto: Higher Education Quality Council of Ontario. Retrieved from January 5, 2012 http://www.ontla.on.ca/library/repository/mon/23008/294772.pdf.

Chickering, A., & Ehrmann, S. E. (1996). Implementing the seven principles: Technology as lever. *AAHE Bulletin*, October, pp. 3–6. Retrieved from April, 2009 http://www.tltgroup.org/programs/seven.html.

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles of good practice in undergraduate education. *American Association for Higher Education Bulletin, 39*(March), 3–7.

Cleveland-Innes, M., & Emes, C. (2005). Principles of a learner centered curriculum: Responding to the call for change in higher education. *Canadian Journal of Higher Education, 35*(4), 85–110.

Cleveland-Innes, M. F., & Garrison, D. R. (Eds.). (2010). *An introduction to distance education: Understanding teaching and learning in a new era*. New York: Routledge.

Entwistle, N. J. (2000). Approaches to studying and levels of understanding: The influences of teaching and assessment. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (pp. 156–218). New York: Agathon Press.

Evans, T., & Nation, D. (2003). Globalization and the reinvention of distance education. In M. G. Moore & W. G. Anderson (Eds.), *Handbook of distance education* (pp. 777–792). Mahwah: Lawrence Erlbaum.

Garrison, D. R. (2000). Theoretical challenges for distance education in the 21st century: A shift from structural to transactional issues. *International Review of Research in Open and Distance Learning, 1*(1), 1–17.

Garrison, D. R. (2007). Online community of inquiry review: Social, cognitive, and teaching presence issues. *Journal of Asynchronous Learning Networks, 11*(1), 61–72.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education, 15*(1), 7–23.

Garrison, D. R., & Cleveland-Innes, M. (2010). Conclusion. In M. F. Cleveland-Innes & D. R. Garrison (Eds.), *An introduction to distance education: Understanding teaching and learning in a new era* (pp. 137–164). New York: Routledge.

Garrison, D. R., & Vaughan, N. (2008). *Blended learning in higher education*. San Francisco: Jossey-Bass.

Grant, M. R., & Thornton, H. R. (2007). Best practices in undergraduate adult-centered online learning: Mechanisms for course design and delivery. *MERLOT Journal of Online Learning and Teaching, 3*(4), 346–362. Retrieved from http://jolt.merlot.org/vol3no4/grant.htm.

Gudea, S. R. (2008). *Expectations and demands in online teaching: Practical experiences*. Pennsylvania: IGI Publishing.

Gumport, P., & Chun, M. (2005). The states and higher education. In P. Altbach et al. (Eds.), *American higher education in the 21st century* (pp. 393–424). Baltimore: John Hopkins University Press.

Ice, P. (2010). The future of learning technologies: Transformational developments. In M. F. Cleveland-Innes & D. R. Garrison (Eds.), *An introduction to distance education: Understanding teaching and learning in a new era* (pp. 137–164). New York: Routledge.

Ickenberry, S. (2001). Forward. In C. Latchem & D. Hanna (Eds.), *Leadership for 21st century learning: Global perspectives from educational perspectives*. Sterling: Stylus Publishing.

Kanuka, H., & Brooks, C. (2010). Distance education in a post-Fordist time: Negotiating difference. In M. F. Cleveland-Innes & D. R. Garrison (Eds.), *An introduction to distance education: Understanding teaching and learning in a new era* (pp. 69–90). New York: Routledge.

Keller, G. (2008). *Higher education and the new society*. Baltimore: John Hopkins University Press.

Kuh, G. D. (2003). What we're learning about student engagement from NSSE: Benchmarks for effective educational practices. *Change, 35*(2), 24–32.

Moore, M. G. (1991). Editorial: Distance education theory. *American Journal of Distance Education, 5*(3), 1–6.

Newlin, M. H., & Wang, A. Y. (2002). Integrating technology and pedagogy: Web instruction and seven principles of undergraduate education. *Teaching of Psychology, 29*(4), 325–330.

Pond, W. K. (2003). Lifelong learning—The changing face of higher education. eLearning Summit. La Quinta Resort, California.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5), 1–6.
Ramsden, P. (2003). *Learning to teach in higher education* (2nd ed.). London: Routledge.
Richardson, J. C., & Swan, K. (2003). Examining social presence in online courses in relation to students' perceived learning and satisfaction. *Journal of Asynchronous Learning Networks, 7*(1), 68–88.
Rourke, L., & Kanuka, H. (2007). Barriers to online critical discourse. *Computer-Supported Collaborative Learning, 2*, 105–126.
Shale, D. (2010). Beyond boundaries: The evolution of distance education. In M. F. Cleveland-Innes & D. R. Garrison (Eds.), *An introduction to distance education: Understanding teaching and learning in a new era* (pp. 91–107). New York: Routledge.
Swan, K. (2002). Immediacy, social presence, and asynchronous discussion. In J. Bourne & J. C. Moore (Eds.), *Elements of quality online education* (Vol. 3, pp. 157–172). Needham: Sloan Center for Online Education.
Swan, K. (2010). Teaching and learning in post-industrial distance education. In M. F. Cleveland-Innes & D. R. Garrison (Eds.), *An introduction to distance education: Understanding teaching and learning in a new era* (pp. 108–135). New York: Routledge.
Swan, K., Shen, J., & Hiltz, S. R. (2006). Assessment and collaboration in online learning. *Journal of Asynchronous Learning Networks, 10*(1), 45–62.
Twigg, C. (2001). Innovations in online learning. Moving beyond no significant difference. The PEW Learning and Technology Program. (symposium monograph). Troy, NY: Center for Academic Transformation. Rensselaer Polytechnic Institute.
Twigg, C. A. (2003). Improving learning and reducing costs: New models of online learning. *Educause Review, 38*, 28–38.
U.S. Department of Education. (2009). *Evaluation of evidence-based practices in online learning*. Retrieved from May, 2010 http://www.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf.
Webster's Collegiate Dictionary. (2002). Springfield, Mass.: Merriam Webster Inc.
Zemsky, R., Wegner, G. R., & Massy, W. P. (2005). *Remaking the American university: Market-smart and mission-centered*. Piscataway: Rutgers University Press.

An Analysis of Success and Failures: Focusing on Learner–Content Interactions for the Next Generation of Distance Education*

Gary R. Morrison and Gary J. Anglin

Over 30 years ago, Bork (1987) stated that the computers would change the way students learn. Prior to Bork, Skinner described how programmed instruction would revolutionize the way students learn; we have also encountered the master teacher on television and a new wave of Web 2.0 technologies that, it is claimed, will transform the way students will learn. Yet 30 years after, Bork suggested major changes in the way students would learn; the majority of the students today still attend class where lectures, bound textbooks, and collections of readings determine the content of the course. The field of instructional technology has had a checkered past concerning the impact of technology (i.e., hardware and software) on learner achievement (Clark 1983, 1994). With each new technological innovation, we have added another layer of complexity on top of the existing classroom without seeking to redesign the instructional environment or the very foundation on which the instruction is based. In this chapter, we will discuss the conceptualization and definitions of distance education, the impact and possibilities of the Internet, lessons learned from past and present implementations, and the role of communication in distance education. We will propose how to use both old and new technologies to refine and evolve the first four generations of distance education. In particular, we argue that learner–content interactions should play a critical role in the design of future distance education instruction.

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G.R. Morrison, Ed.D (✉)
STEM and Professional Studies, Old Dominion University, 228 Education Building, Norfolk, VA 23529, USA
e-mail: GMorriso@odu.edu

G.J. Anglin, Ed.D
Curriculum and Instruction, University of Kentucky, 137 Taylor Education Building, Lexington, KY 40506, USA

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Distance Education Today

There are three factors that impact distance education: (a) the concept of distance education, (b) the learner, and (c) distance education delivery. First, the way distance education is defined is a critical issue. Second, our characterization of the nontraditional learner in distance education is evolving. Third, our choices of how to deliver distance education have changed. Underlying these three factors are the related theories and research for making sound instructional decisions.

Defining Distance Education

Individual perceptions of distance education vary greatly between researchers. Views of distance education are almost as varied as the many types of automobile racing. For example, stating that you are going to an automobile race provides your listener little information. An Indy car, NASCAR, and a kart race all travel around an oval or a round track, while Formula 1 racing is on a closed loop (not an oval), but each type of automobile racing has significant variations in rules and strategies. Similarly, a track race varies greatly from an autocross, a rally, and/or a cross-country race like the Paris–Dakar race. While a few cars are wrecked in these races, these races are quite different than the intentions of a demolition derby that literally seeks to disable the other vehicles through intentional collisions. Thus, telling someone that you are going to an automobile race has little meaning beyond the fact that cars will be driven. Similarly, stating that you are writing about some aspect of distance education has little meaning given the variations in definition. The primary difference between distance education definitions is the degree of separation of the teacher and student. For example, when defining distance education, Holmberg (1977), Keegan (1996), and Garrison and Shale (1987) state that the learner and teacher are separated in both location and time indicating all (or all but a very few) of the interactions are asynchronous. Others, however, state that the learner and teacher must be separated in either location *or* time (Moore 1990; Simonson et al. 2000). A definition of distance education that allows for the separation of the learner and teacher in time or geographic location broadens the type of environments and instructional strategies included in distance education programs. For example, requiring students to meet at the same time although they are geographically separated using computer technology such as two-way audio and video, one-way video and two-way audio, or in an online chat room is often grouped in the same category of distance education as the traditional correspondence course. The more powerful the technology (e.g., two-way audio and video) in resembling face-to-face communication, the more the distance education environment will resemble a traditional classroom (Simonson et al. 1999). When students and teacher are only separated in time but not location, the environment may resemble a course similar to Keller's (1968) personalized system of instruction or (Postlethwait & Hurst, 1972) audio-tutorial approach. Some of definitions stipulate that the course is offered by a formal institution (Keegan 1996; SACs 2009), thus watching videos on YouTube or participating in a public blog are not considered distance education. The common theme in the newer definitions is that they incorporate the use of two-way communication in a synchronous mode (Moore 1990; Simonson et al. 2000).

Keegan (1996) suggests that courses that depend primarily on synchronous communication are not distance education courses, but rather virtual systems. These systems impose many of the same constraints as traditional face-to-face classroom courses by requiring students to attend virtual classroom meetings at the same time from different locations using a personal Internet connection or they must travel to a remote classroom site. We will define distance education as a permanent (primarily) separation of the student and teacher in time and geographical location using electronic tools for communication and enrolled in a course offered by a formal institution. As described by Keegan, distance education that relies primarily on synchronous delivery is distinct from our definition of distance education.

The Nontraditional Learner

Prior generations of distance education programs that incorporated correspondence (e.g., postal mail), radio, and broadcast television as the delivery technology served nontraditional learners. These nontraditional learners typically lived at a distance from a college campus and could not attend a traditional classroom course. The alternative was some form of distance education such as broadcast television courses developed by the University of Mid-America and broadcast over local public television stations. Today's nontraditional learner has some of the same characteristics of yesterday's nontraditional learner. However, the current nontraditional learner varies from traditional learner in three ways (Bean and Metzner 1985). First, the nontraditional learner commutes to campus. Second, the nontraditional learner is typically older than the traditional learner. Third, nontraditional learners typically attend classes part-time. This subtle shift in the definition of the nontraditional learner from one who was remote from campus to one who commutes to campus has implications for the location of the delivery of distance education and impacts the how it is defined.

Delivery of Distance Education

We can trace the development of distance education through four generations. The first generation is defined by the correspondence courses. These courses were asynchronous, self-paced instruction that focused primarily on learner–content interactions with some learner–instructor interactions that were limited by the use of postal mail for communication. The second generation consisted of broadcast television courses that were produced by organizations such as the University of Mid-America, British Open University, and Dallas Community College. The programs and course materials were leased or rented by other universities, and students viewed programs broadcasted on public television networks or more recently on cable television channels. The weekly television broadcasts imposed a group-pacing mode on the learner, although the majority of the interaction was learner–content with no interaction with the television instructor, but rather with an instructor (typically, on a very limited basis) from the credit offering university. Web-based courses provided the transition to the third generation of distance education. As the technology has developed, web-based courses have evolved from a self-paced, individualized format much like a correspondence course to self-paced courses with multimedia-enhanced learner–content interactions to courses that are based primarily on learner–learner interactions. The fourth generation of distance education makes use of two-way audio and video technologies to create a virtual classroom environment that replicates the traditional face-to-face classroom environment. While some definitions consider this environment as a type of distance education (e.g., Simonson et al. 2000), Keegan (1996) places them into a special category of virtual classrooms.

Some of the traditional definitions (e.g., Garrison and Shale 1987; Holmberg 1977; Keegan 1996) define distance education by the separation of the learner and teacher in both time and location. Today, the various implementations of distance education challenge this basic concept. Next, we will examine three categories of distance education by location. First, there is "on-campus" distance education that involves the use of hybrid courses or online courses for students who typically attend classes on campus. A traditional class might employ a hybrid format that includes online activities such online discussion and chats for students as either a supplement or to replace traditional face-to-face meetings such as a discussion section. Similarly, an on-campus student might enroll in an online course due to the flexibility of not having to attend a regularly scheduled class. Second, there is "near-campus" delivery. These students might attend classes at an off-campus center via a video link or online but can also attend meetings on campus as needed. The third implementation is labeled "far-distance" delivery and includes those learners who cannot attend campus but may connect via video (one-way and two-way) or online using meeting software such as Adobe Connect.

It is this combination of location, technology, and delivery methods that extends the definition of distance education beyond serving just the nontraditional learner. Another difference between these delivery systems is the pacing mode. The virtual classrooms are a replication of traditional face-to-face classrooms and are group-paced. That is, all students are on the same page at the same time. In the virtual classroom, tests are given in unison, papers are due at a specific time, and lectures and discussions are on a specific topic at a specific time (e.g., the class meeting time). An online course can have features of group pacing and/or self-pacing. For example, an online course that requires students to participate in a live chat, lecture, online discussion forum, or audio-based discussion (e.g., Skype) would be group-paced even if the course is described as asynchronous. For example, online interactions, even a discussion forum, need to occur in a contiguous time frame to be meaningful. The flow and purpose of the interaction would be lost if individual students could make their first postings over a period of a semester rather than a shorter time frame such as a week. In contrast, an online course that allows individuals to work independently with flexible assignment submission is self-paced (we would also include classes that specify a deadline for submission of assignments but allow early submission with progress to the next unit as self-paced). While we equate group-paced with a synchronous course, not all asynchronous courses are self-paced.

Our focus in this chapter is on the next generation of distance education, with an emphasis on designing self-paced, interactive instruction. While it is clear that several types (learner–learner, learner–instructor, learner–content) of interactions are important components of distance learning instruction, we will focus on learner–content interactions (Bernard et al. 2009). In the next section, we will examine issues that impact this approach.

Issues Impacting the Design of Distance Education Instruction

Most educational researchers and faculty would agree that distance education is generally different from the traditional classroom when the learner and the instructor are separated in both time and geographic location. With the increased importance of technology in the instructional environment, instructional designers often work with faculty on the design of the materials, yet this relationship is often contentious (Kanuka 2006; Tessmer 1988). In this section, we will examine the role of instructional design in the next generation of distance education.

The Textbook and the Classroom

Distance education has relied on electronic technologies since the second generation. According to Heinich (1985), technology-based instruction poses a threat to the educational system, especially when technology becomes an alternative rather than a complement to traditional classroom instruction. Today, with computer technology, technology can assume a major responsibility for the delivery of the instruction, especially in a distance education course that relies heavily on the technology to deliver the instruction. Heinich compares the process of teaching to a skilled craftsperson where the emphasis is on the use of tool by the craftsperson and decision making is an ad hoc process. In contrast, technology focuses on the design of tools that are used to produce reliable and reproducible products. As a result, the technology products are the effort of a team rather than of a single craftsperson. Transitioning instruction from a craft-based approach to a technology-based approach requires a change in organizational structure.

There is a symbiotic relationship between the instructor and the textbook that allows the textbook to endure as the primary source of information in courses

(Heinich 1984). Publishers avoid changing the textbook as this relationship between the instructor and text would be upset if the textbook assumed more of the instructional approach as opposed to an almost purely a source of information. Textbooks typically have varying numbers of pedagogical aids, but these are seen as still requiring the assistance of the instructor to be meaningful and useful to the learner. If the textbook were to become more self-instructional by design, then the instructor's role would be lessened, and the relationship between the instructor and textbook would be changed. As we transition to the next generation of distance education, we might expect that some of the instructor–learner interactions might be replaced by content–learner interactions facilitated by computer technology. Thus, a distance education course developed by an instructional designer might similarly challenge this role between the instructor and textbook by providing learner–content interactions in a self-paced course.

Shovelware and Online Instruction

Web-based or e-learning technologies may be some of the most misunderstood technologies. Early and continuing efforts to produce online courses have often resulted in shovelware products. That is, instructors transferred classroom materials such as PowerPoint presentations and handouts to the web in an effort to create a course (Morrison and Anglin 2006). The results were posted information but without instruction (including strategies) as the materials lacked the contribution of the instructor, resulting in poor design (Cone and Robinson 2001; Fabry 2009). Instruction is more than just the slides from a PowerPoint presentation; instruction includes both information and planned instructional strategies that help the learner understand the content and transfer the information to long-term memory for later retrieval. Shovelware lacks the instructional strategies as well as the complete information needed to develop an adequate understanding. Morrison and Anglin (2006) provide a model for disassembling the content of an online class and then determining the adequacy of the instruction.

Two Barriers to Distance Education Instruction

The combination of the separation of the learner and instructor and computer technology to deliver the instruction creates a unique environment in higher education. Two factors are consistently cited as barriers to adopting distance education at either the university or faculty level (Berge et al. 2002; Chen 2009). The first factor is the cost to develop individual courses. A shovelware approach is not an effective approach. A viable alternative for creating instruction is the use of an instructional design team (Hawkes and Coldeway 2002; Kanuka 2006; Morrison et al. 2011) that considers the task from the students' view and then designs the appropriate instructional strategies.

This process has significant front-end costs; however, the costs should be amortized across the life of a course. A second barrier to adoption is the concern with an increase in faculty workload. The general impression is that a distance education course requires more time on the part of the instructor (Dibiase and Rademacher 2005; Ellis 2000). While faculty seldom report hours spent on different tasks, individual reports do suggest an increased workload of 30–85% (Dibiase and Rademacher 2005), with the development time accounting for a great deal of the effort.

Interaction

Interaction in distance learning instruction is a growing trend that was stimulated by research on programmed instruction (Markle 1969). The research investigated and verified a number of interactive strategies. In distance education, interactions are typically classified as occurring between two or more students, the student and the instructor, or the student and the content. Anderson (2003) proposed the equivalency theorem that stated, "Deep and meaningful formal learning is supported as long as one of the three forms of interaction (student–teacher; student-student; student-content) is at a high level" (p. 4). A recent trend in distance education is based on a social-constructivist approach with a strong emphasis on learner–learner interactions as key component for learning (Kanuka and Brooks 2010). One paradigm for implementing this approach is the Community of Inquiry (Garrison et al. 2000) approach. A recent analysis of over 250 studies on Community of Inquiry (CoI) failed to find support for the deep meaningful learning as a result of the online learner–learner interactions (Rourke and Kanuka 2009). In a meta-analysis of interactions in distance education, Bernard et al. (2009) found a greater effect for learner–content and learner–student interactions than for student–teacher interactions. However, they caution that students' perception of interaction is a better predictor of course satisfaction than actual measures of interaction. In addition, the learner–content interactions were the only category that produced significant between-class differences as well as a positive linear relationship with effect size. After reviewing the research on aptitude treatment interactions, Jonassen and Grabowski (1993) suggest that designers focus on learner–content treatment interactions. That is, adapting the instruction to the task so that we are teaching in a manner that supports the knowledge or skill the learner must gain.

Heinich (1984, 1985) warned of problems when the symbiotic relationship between the instructor and textbook is changed and when technology is used as a tool for instruction as we move from a craft-based approach to teaching. The literature suggests that an approach is needed to the design of distance education instruction that goes beyond shovelware. The current trend with an emphasis primarily on learner–learner interactions has failed to produce results that support the development of deep, meaningful learning. In the next section, we will examine the use of learner–content interactions in next generation of distance education.

Instructional Design in the Next Generation of Distance Education

Current trends in distance education suggest two approaches at the opposite ends of a continuum—self-directed learning (SDL) and Community of Inquiry. The SDL camp has a lengthy history in not only distance education starting with correspondence courses but also with a rich and significant set of strategies and research in traditional education that are also applicable to distance education. The second camp subscribes to the Community of Inquiry (CoI) approach based on social constructivism. It appears that there is little overlap between these two camps or opportunities for merging ideas. For example, Garrison (2009) stated, "As in real life, it is inadvisable to go too far on one's own in interpreting and understanding life's phenomena because it is too easy to be wrong or to become fixed and dogmatic in one's views" (p. 4). However, the research on individualized instruction and self-regulation provides substantial support for individualized instruction, contrary to Garrison's claim.

Supporting Evidence for Individualized Instruction

Recent research (Rourke and Kanuka 2009) has been critical of the Community of Inquiry concluding, "Conceptual frameworks of social presence, teaching presence, and cognitive presence (and the corollary prescriptions for instructional designers) that are unconnected to empirical evidence of deep and meaningful learning are, on the face of it, groundless" (p. 44). The CoI framework emphasizes learner–learner and learner–instructor interactions to develop an understanding and deep level of meaning. Yet, significant research on the CoI approach does not support the strategy. Other reviews of inquiry learning (Kirschner et al. 2006; Mayer 2004) have failed to find support for the minimal guidance of a constructivist approach.

The research supporting a self-directed or individualized approach to distance education includes a variety of strategies. For example, Kulik and his associates' meta-analysis studies of one form of individualized instruction, computer-based instruction, found a positive effect ranging from an effect size of 0.25 to 0.31 for individualized treatments (Kulik and Kulik 1986, 1991; Kulik 1983; Kulik et al. 1980a, b; Kulik et al. 1979). When examining specific strategies such as Keller's personalized system of instruction (Keller 1968), Kulik et al. (1979) found an effect size for achievement of 0.69 favoring the personalized system of instruction. In another study, Kulik et al. (1980a, b) grouped studies of four different forms of individualized instruction (personalized system of instruction, audio-tutorial approach (Postlethwait and Hurst 1972), programmed instruction, and visual-based instruction) they labeled as instructional technology. The meta-analysis revealed a positive effect size of 0.28 for instructional technology. We can also consider other instructional strategies for use in individualized instruction including generative strategies (Grabowski 2004; Wittrock 1974a, b, 1989) and self-regulated learning (Winne and Hadwin 1997; Winne and Stockley 1998;

Zimmerman 1990) that contribute to learners developing an understanding and deeper learning. There is strong support for the design of learner–content interactions that will help the learner develop an understanding of the content.

Designing the Next Generation of Distance Education

Today, there are two primary points of view concerning the design of distance instruction: the self-directed or individualized instruction approach that emphasizes learner–content interactions and the social-constructivist approach which places a stronger emphasis on the use of online discussions to negotiate meaning between students and the instructor. Given these diverse views, is it possible to create a next generation of distance education that would incorporate both views?

Design of Distance Instruction

Online courses must be more than shovelware (Fish and Wickersham 2009; Morrison and Anglin 2006). That is, an instructor or course facilitator cannot expect to create a successful course by simply posting lecture notes, handouts, and presentation slides on the Internet. While it is possible to convert a traditional classroom course for use on the web, careful consideration must be given to the design of instruction for delivery in a different environment. For example, on-campus and near-campus distance courses may closely resemble a traditional classroom with added technology adjuncts. Yet, the traditional support of easy access to the instructor and face-to-face contact with other students may provide additional supports that mitigate poor course designs. Several authors have concluded that online courses are often based on intuitive decision making rather than research-based strategies resulting in poor course designs (Koszalka and Ganesan 2004; Pomales-Garcia et al. 2010). Similarly, the use of learning management systems such as Blackboard often distracts the designer or instructor from employing good design principles (Fish and Wickersham 2009). Designing distance instruction is different from designs for the traditional classroom course due to the separation of the student and instructor in either time and/or location.

Industrialization in Postindustrial Distance Education

When there is a separation of the learner and instructor in both time and location, the traditional sources of instructional support disappear and there is a great need for reliance on well-designed instructional materials. Garrison (2009), however, raises a concern with SDL. He states, “Students are generally deficient to some extent in terms of the three dimensions of SDL—management, monitoring, and motivation” (p. 95). These same three dimensions affect both a self-directed approach as well as a social-constructivist approach. However, we believe that the argument that self-directed students are more likely to fail is unfounded. In a recent study comparing students in a correspondence course and those in a course designed around collaborative learning, the participants in the correspondence treatment were significantly more likely to persist and complete the course than the collaborative treatment (Poellhuber et al. 2008). Similarly, the researchers found little evidence of online interactions in the collaborative group. Poellhuber et al.'s (2008) results reflect those of Rourke and Kanuka (2009); they found no evidence for deeper levels of learning with a collaborative (i.e., CoI) approach. In support of the SDL approach, we have already summarized research that shows significant gains for learners in individualized instruction treatments.

The development of materials by someone other than the instructor has been labeled as the industrialization of distance education (Garrison 2009) and was popularized in the literature by Peters (1993) who described an instructional development approach to designing distance instruction using a specialized team that included a subject-matter expert. Today, we find the instructional design approach implemented in a variety of ways. Examples of Peter's conceptualization are large-scale implementations such as the British Open University and the University of America where complete course packages were developed and then distributed and taught or facilitated by individuals who were not part of the design team. Presently, we see many universities implementing a similar approach to course design (Koszalka and Ganesan 2004); however, the courses are generally used only at a single institution.

Why an Instructional Design Approach?

The design of distance instruction, and particularly online instruction, requires more time and effort than a traditional teacher- or content-centered approach. Such demands can easily overwhelm a single faculty member who has no expertise in the design of instruction, especially in a distance environment. Similarly, simply posting traditional classroom materials has been found to be an ineffective approach (Fish and Wickersham 2009; Morrison and Anglin 2006). For the next generation of distance education, while learner–learner, learners–instructor, and learner–content interactions are all significant components of a distance learning course, we argue for a greater emphasis on learner–content interactions that can provide a foundation for informed learner–learner and learner–instructor interactions. The next section describes the components of the next generation of distance education.

Defining the Next Generation of Distance Education

We propose two major components for the next generation of distance education. The first is an individualized approach that emphasizes learner–content interactions to support the development of schemas. Second, we suggest the inclusion of learner–learner and learner–instructor interactions that allow for testing and refinement of ideas. Each component is described below.

Learner–Content Interactions

There is a rich research base for learner–content interactions in both the instructional technology and educational psychology literature. These studies are wide ranging from strategies to memorize factual information using elaborative interrogation (Woloshyn et al. 1994) to studies employing multimedia to develop a conceptual understanding (Mayer and Moreno 2002). These learner–content interactions are easily embedded within two distance education paradigms. First is Keegan's (1996) reintegration of the teaching act. According to Keegan, the instructional materials must help the learner reconstruct the learner–instructor interaction in a different time frame. That is, the instructional materials are designed in such a way to help the learner have an internal conversation (Vygotsky 1962) with the instructor, or more precisely, the subject-matter expert. Second, Holmberg (1989) describes the guided didactic conversation, that is, a simulated conversation between the student and the instructor in the instructional materials. Both of these approaches suggest an individualized approach to designing the materials in contrast to a more scholarly approach taken with most textbooks and journal articles. One approach to designing individualized instruction is the generative learning theory (Wittrock 1974b) that provides a variety of prescriptions to assist the learner in modifying and generating new schema.

Generative learning theory was proposed by Wittrock (1974b) as means to help learners generate new knowledge by relating what they read or hear and then integrate that information with their prior knowledge (Mayer 2010). The act of generating new knowledge by relating the presented information to prior knowledge requires active learning (Grabowski 2004). There are four general categories of information processing strategies that are considered generative strategies (Jonassen 1988). The four categories and example strategies are recall (rehearsal and mnemonic), integration (paraphrasing and exemplifying), organizing (analysis of key ideas and outlining), and elaboration (analogies and sentence elaboration). These strategies are easily integrated into the course content or study guide to help the learner construct new knowledge. These strategies can be used with any technology from print to streaming audio and video to multimedia. Generative strategies are designed through purposeful efforts of the instructional design and/or instructor.

Learner–Learner Interactions

In summarizing the literature on discovery or inquiry learning, Kirschner et al. (2006) concluded that the inquiry approach was ineffective when compared to a direct instruction approach. They suggested that many who practice inquiry learning do not make a distinction between doing inquiry in the discipline and learning a discipline through inquiry, and those who use an inquiry approach for teaching are "guilty of the improper use of inquiry as a paradigm on which to base an instructional strategy" (Kirschner et al., p. 79). Recognizing that learner–learner interactions are beneficial (Bernard et al. 2009), we propose a different approach for stimulating the interactions. First, sequencing of the instruction is critical. In the next generation of distance education, we believe that the implementation of the instruction should start with the learner–content interactions where the learners first generate new knowledge by interacting with the content. Second, they then engage in meaningful, informed learner–learner interactions. Rather than using an inquiry approach to structure the discussions, we propose using a combination of higher order questions and questions that develop inquiry skills related to the discipline to stimulate discussion. The inquiry questions would focus on applying their newly constructed knowledge to investigate questions within the discipline.

Learner–Instructor Interactions

There are two types of instructors in the learner–instructor interactions. The first instructor is subject-matter expert whose "voice" is embedded in the content developed by an instructional design team. This instructor may not be the actual instructor in the classroom. Courses that incorporate video might use on-camera talent that serves as yet another instructor and may be different from the subject-matter expert. The second instructor is the instructor of record and is responsible for assigning grades to the individual students. The instructor of record may be the same as the subject-matter expert or may have had no input in the design of the course. The following sections describe how the instructor of record can personalize and adapt course for local use.

Personalizing the Course

Course design can take place at three different levels. First, all course design and development can be done by a single instructor, typically the instructor of record. Components (i.e., print, video, audio, and multimedia) integrated into the design of the course are generally determined by the instructor's resources and skills. Second, an instructor may have access to a support group on campus that can provide resources and assistance with design and development. Courses developed at this level may be for a single instructor or may use a senior-level instructor/subject-matter expert to design and develop a course that will have different instructors of record. Third, the course may be developed by an external organization such as Annenberg Media, Great Plains National, or Dallas Community College. The instructor of record typically will serve as a facilitator and not have any input into the design of the courses.

As part of the next generation of distance education, we propose a means for individual instructors to personalize course materials when they are developed by others. The following paragraphs describe some basic approaches to personalization.

Print Materials

If the course developers do not specify or require a specific textbook, the instructor or group of instructors has the option to select the textbook for a course. For example, it is not unusual for a department to specify a single textbook for large enrollment courses or for courses taught by adjunct faculty. Selecting a textbook either individually or as a team provides a way for faculty to personalize the course.

We recommend that study guides be provided in an editable format such as a word processing file. Individual instructors can then modify the study guide to reflect their personal approach to the course. Simple personalization can include adding the university's course number, title, and the instructor's contact information to the main page. Similarly, an instructor might wish to include the course syllabus as part of the study guide. More extensive personalization could involve adding or modifying introductions to units and readings as well as the addition of generative strategies to the study guide. Personalization of the study guide allows the instructor to adapt it to a specific institution and course to add the instructor of record's voice to the course materials.

Video Materials

For instructors who prefer a more traditional lecture-based approach, the production of short, video-streaming lectures provide an additional way for the instructor to personalize the course. These lectures can focus on topics of personal interest of the instructor, supplemental topics, information to localize the content, or to provide additional elaboration on specific topics. These productions can also provide the student with an opportunity to develop parasocial contact (Horton and Wohl 1956) with the instructor of record.

Discussions

The last form of personalization is modifying or creating online discussions. This personalization allows the instructor a great deal of flexibility with minimal required resources. The instructor can modify or create new online discussions adapted to areas of personal interest, topics that need additional elaboration, or topics that will localize the content.

Summary

In this chapter, we have developed a framework for the next generation of distance education. We first discussed the changing landscape of distance learning including such issues as the evolution of the nontraditional learner and distance education delivery; factors that currently impact distance learning design including textbooks, shovelware design, and interaction were also examined. We then discussed issues we believe will and should impact the design of the next generation of distance education courses and programs. It is argued that a self-regulated, individualized approach to the design of distance learning instruction should be considered. The proposed approach focuses on designing course materials that emphasize the learner–content interactions using generative strategies. Our emphasis is on an instructional design team approach that also includes a means for individual instructors to personalize the course materials.

References

Anderson, T. (2003). Getting the mix right again: An updated and theoretical rationale for interaction. *International Review of Research in Open and Distance Learning, 4*(2), 2–14.

Bean, J. P., & Metzner, B. S. (1985). A conceptual model of nontraditional undergraduate student attrition. *Review of Educational Research, 55*(4), 485–540.

Berge, Z. L., Muilenburg, L. Y., & Haneghan, J. V. (2002). Barriers to distance education and training. *Quarterly Review of Distance Education, 3*(4), 409–418.

Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, C. A., Tamim, R. M., Surkes, M. A., et al. (2009). A meta-analysis of three types of interaction treatments in distance education. *Review of Educational Research, 79*, 1243–1289. doi:10.3102/0034654309333844.

Bork, A. (1987). *Personal computers for education*. New York: Harper & Row.

Chen, B. (2009). Barriers to adoption of technology mediated distance education in higher-education institutions. *Quarterly Review of Distance Education, 10*(4), 333–338.

Clark, R. E. (1983). Reconsidering the research on media. *Review of Educational Research, 53*(4), 445–459.

Clark, R. E. (1994). Media will never influence learning. *Educational Technology Research and Development, 42*(2), 21–29.

Cone, J. W., & Robinson, D. G. (2001). The power of e-performance. *Training and Development, 55*(8), 32–41.

Dibiase, D., & Rademacher, H. J. (2005). Scaling up: Faculty workload, class size, and student satisfaction in a distance learning course on geographic information science. *Journal of Geography in Higher Education, 29*(1), 139–158.

Ellis, E. M. (2000). Faculty participation in the Pennsylvania State University world campus: Identifying barriers to success. *Open Learning, 15*(3), 233–242.

Fabry, D. L. (2009). Designing online and on-ground courses to ensure comparability and consistency in meeting learning outcomes. *Quarterly Review of Distance Education, 10*(3), 253–261.

Fish, W. W., & Wickersham, L. E. (2009). Reminders. *Quarterly Review of Distance Education, 10*(3), 279–284.

Garrison, D. R. (2009). Implications of online learning for the conceptual development and practice of distance education. *Journal of Distance Education, 23*(2), 93–104.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment computer conferencing in higher education. *The Internet and Higher Education, 2*(2–3), 87–105.

Garrison, D. R., & Shale, D. (1987). Mapping the boundaries of distance education: Problems in defining the field. *American Journal of Distance Education, 1*, 4–13.

Grabowski, B. J. (2004). Generative learning contributions to the design of instruction and learning. In D. J. Jonassen (Ed.), *Handbook of educational communications and technology* (2nd ed., pp. 719–743). Hillsdale: Lawrence Erlbaum Associates.

Hawkes, M., & Coldeway, D. O. (2002). An analysis of team vs. faculty-based online course development: Implications for instructional design. *Quarterly Review of Distance Education, 3*(4), 431–441.

Heinich, R. (1984). The proper study of instructional technology. *Educational Communications and Technology Journal, 32*(2), 67–87.

Heinich, R. (1985). Instructional technology and the structure of education. *Educational Communications and Technology Journal, 33*(1), 9–15.

Holmberg, B. (1977). *Distance education: A survey and bibliography*. London: Kogan Page.

Holmberg, B. (1989). *Theory and practice of distance education*. New York: Routledge.

Horton, D., & Wohl, R. R. (1956). Mass communication and para-social interaction. *Psychiatry, 19*(3), 215–229.

Jonassen, D. (1988). Integrating learning strategies into courseware to facilitate deeper processing. In D. Jonassen (Ed.), *Instructional designs for microcomputer courseware* (pp. 151–181). Hillsdale: Lawrence Erlbaum Associates.

Jonassen, D. H., & Grabowski, B. L. (1993). *Handbook of individual differences, learning, and instruction*. Hillsdale: Lawrence Erlbaum Associates.

Kanuka, H. (2006). Instructional design and eLearning: A discussion of pedagogical content knowledge as a missing construct. *E-Journal of Instructional Science and Technology, 9*(2).

Kanuka, H., & Brooks, C. (2010). Distance education in post-fordist time. In M. F. Cleveland-Innes & D. R. Garrison (Eds.), *An introduction to distance education: Understanding teaching and learning in a new era* (pp. 69–90). New York: Routledge.

Keegan, D. (1996). *Foundations of distance education* (3rd ed.). London: Routledge.

Keller, F. S. (1968). Goodbye teacher…. *Journal of Applied Behavioral Analysis, 1*, 79–89.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist, 41*(2), 75–86.

Koszalka, T. A., & Ganesan, R. (2004). Designing online courses: A taxonomy to guide strategic use of features available in course management systems (cms) in distance education. *Distance Education, 25*(2), 243–256.

Kulik, C.-L. C., & Kulik, J. A. (1986). Effectiveness of computer-based education in colleges. *AEDS Journal, 19*, 81–108.

Kulik, C.-L. C., & Kulik, J. A. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computers in Human Behavior, 7*, 75–94.

Kulik, C.-L. C., Kulik, J. A., & Cohen, P. A. (1980a). Instructional technology and college teaching. *Teaching of Psychology, 7*(4), 199–205.

Kulik, J. A. (1983). *Effects of computer-based teaching on learners*. In Paper presented at the National Forum of the College Board symposium on computer competency and the curriculum, Dallas, Texas. http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED246877&site=ehost-live. Access on May 24, 2010.

Kulik, J. A., Kulik, C.-L. C., & Cohen, P. A. (1979). A meta-analysis of outcome studies of Keller's personalized system of instruction. *The American Psychologist, 34*(4), 307–318.

Kulik, J. A., et al. (1980b). Effectiveness of computer-based college teaching: A meta-analysis of findings. *Review of Educational Research, 50*(4), 525–544.

Markle, S. (1969). *Good frames and bad: A grammar of frame writing*. New York: Wiley.

Mayer, R. E. (2004). Should there be a three-strikes rule against pure discovery learning? *The American Psychologist, 59*(1), 14–19.

Mayer, R. E. (2010). Merlin C. Wittrock's enduring contributions to the science of learning. *Educational Psychologist, 45*(1), 46–50. doi:10.1080/00461520903433547.

Mayer, R. E., & Moreno, R. (2002). Aids to computer-based multimedia learning. *Learning and Instruction, 12*, 107–119.

Moore, M. (1990). Background and overview of contemporary American distance education. In M. Moore (Ed.), *Contemporary issues in American distance education* (pp. xii–xxvi). New York: Pergamon.

Morrison, G. R., & Anglin, G. J. (2006). An instructional design approach for effective shovelware: Modifying materials for distance education. *Quarterly Review of Distance Education, 7*(1), 63–74.

Morrison, G. R., Ross, S. M., Kalman, H. K., & Kemp, J. E. (2011). *Designing effective instruction* (6th ed.). Hoboken: Wiley.

Peters, O. (1993). Distance education in a postindustrial society. In D. Keegan (Ed.), *Theoretical principles of distance education* (pp. 39–58). New York: Routledge.

Poellhuber, B., Chomienne, M., & Karsenti, T. (2008). The effect of peer collaboration and collaborative learning on self-efficacy and persistence in a learner-paced continuous intake model. *Journal of Distance Education, 22*(3), 41–62.

Pomales-Garcia, C., Lopez, A. D., & Liu, Y. (2010). Design dimensions and attributes for web-based distance learning modules. *American Journal of Distance Education, 24*(1), 21–39.

Postlethwait, S. N., & Hurst, R. N. (1972). The audio-tutorial system: Incorporating minicourses and mastery. *Educational Technology, 12*(9), 35–37.

Rourke, L., & Kanuka, H. (2009). Learning in communities of inquiry: A review of the literature. *Journal of Distance Education, 23*(1), 19–48.

SACs. (2009). *Distance and correspondence education: Policy statement*. Decatur: Southern Association of Schools and Colleges.

Simonson, M., Schlosser, C. A., & Hanson, D. (1999). Theory and distance education: A new discussion. *American Journal of Distance Education, 13*(1), 60–75.

Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2000). *Teaching and learning at a distance: Foundations of distance education*. Columbus: Merrill.

Tessmer, M. (1988). What's on second. *Performance and Instruction, 27*(9), 5–6. doi:10.1002/pfi.4170270903.

Vygotsky, L. S. (1962). *Thought and language*. Cambridge: MIT Press.

Winne, P. H., & Hadwin, A. F. (1997). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky, & A. C. Graeser (Eds.), *Metacognition in educational theory and practice* (pp. 279–306). Hillsdale: Erlbaum.

Winne, P. H., & Stockley, D. B. (1998). Computing technologies as sites for developing self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self regulated learning: From teaching to self-reflective practice*. New York: Guilford Press.

Wittrock, M. C. (1974a). A generative model of mathematics education. *Journal for Research in Mathematics Education, 5*(4), 181–196.

Wittrock, M. C. (1974b). Learning as a generative process. *Educational Psychologist, 19*(2), 87–95.

Wittrock, M. C. (1989). Generative processes of comprehension. *Educational Psychologist, 24*, 345–376.

Woloshyn, V. E., Paivio, A., & Pressley, M. (1994). Use of elaborative interrogation to help students acquire information consistent with prior knowledge and information inconsistent with prior knowledge. *Journal of Educational Psychology, 86*(1), 79–90.

Zimmerman, B. J. (1990). Self regulated learning and academic achievement. *American Educational Research Journal, 25*, 3–17.

Epilogue
Classic Articles in Instructional Design and Distance Education

Jennifer R. Morrison and Stacey Greenwell

During the summer conference where the papers in this book were presented, the presenters agreed that a chapter was needed on classic articles from the literature on instructional design and distance education. The purpose of this chapter was to present articles that may have been forgotten or simply unknown to new professionals in the field. Participants were asked to submit their recommendations and others were solicited for suggestions. We would like to thank all who contributed and Ward Cates for providing us access to a list he developed simultaneously with recommendations from faculty members.

After reviewing the list, we determined guidelines were needed to narrow the recommendations to a manageable size for the chapter. The first criterion was that any article, paper, or book had to have a publication date prior to 2000, the "ten year rule." However, we made one exception to include the second edition of the *Handbook for Research in Educational Communications and Technology* due to its significant collection of chapters. Second, we decided not to reference individual chapters of an edited book, but rather to cite the complete book. Third, any papers presented at a conference that were cited had to be retrieval either through the Internet or a document service such as ERIC. The list of classic articles and books is certainly not exhaustive. There are many other articles that we could not include due to page limitations.

The following pages include summaries of over 30 articles, papers, and books that met the criteria we established. Summaries for papers and journal articles were developed from the abstracts. Full references are provided to facilitate your retrieval of the citation (Gary R. Morrison and Gary J. Anglin).

J.R. Morrison M.S (✉)
e-mail: jmorr065@odu.edu

S. Greenwell Ed.D
Old Dominion University, Norfolk, VA 23529, USA University of Kentucky Libraries, Lexington, KY, 40506, USA
e-mail: staceyg@email.uky.edu

L. Moller and J.B. Huett (eds.), *The Next Generation of Distance Education: Unconstrained Learning*, DOI 10.1007/978-1-4614-1785-9,

Andre, T. (1979). Does answering higher-level questions while reading facilitate productive learning? *Review of Educational Research, 49*(2), 280–318. doi: 10.3102/00346543049002280.

[This paper explored the effect different levels of questions asked during instruction (mathemagenic activity) had on learning. First, the author examines the research on levels of questions (1) in classroom recitation or discussion, (2) within text or instructional media, (3) on examinations, (4) asked by students of themselves while studying. From this research, the author concludes that higher level questions can have facilitative effects on knowledge but the conditions are unclear. Andre then proposes a model of productive learning that helps to organize the research from question level effects and to describe the information processing system that may account for question level effects.]

Anglin, G. J. (Ed.). (1991). *Instructional technology: Past, present and future*. Englewood, CO: Libraries Unlimited.

[This book is a collection of works by my many leading professionals that were and/or are working in instructional design and technology. Authors of the chapters discussed issues of concern for the field in areas such as domains and definitions of the field, critical issues for the field in 1991, instructional development, research and evaluation, and predicted future prospects for instructional design and technology.]

Clark, R. E. (1983). Reconsidering research on learning from media. *Review of Educational Research, 53* (4), 445–459.

[This article reviews research on the effect of media on learning and discusses the lack of learning benefits found in media comparison studies. Clark attributes performance and time-saving gains found in select studies to novelty effects and issues with uncontrolled variables. Media attribute and system theories are also discussed.]

Clark, R. E. (1994). Media will never influence learning. *Educational Technology Research & Development, 42*(2), 21–29.

[Clark writes to more clearly explain points he made in his original media debate article. He challenges supporters of a specific media to consider the replaceability of one media for another and to then choose the less expensive route to achieve a learning goal. Finally, he summarizes arguments on media effects and addresses specific points of criticism by Robert Kozma. (See this special issue for additional articles on this topic, often referred to as the "Great Media Debate").]

Dale, E. (1969). *Audiovisual methods in teaching* (3rd ed.). New York: Holt, Rinehart, and Winston, Inc.

[Learning activities and communication can be described in Dale's Cone of Experience, a visual model which shows the progression of learning from direct experiences to learning via various forms of media to the understanding of verbal symbols. The Cone of Experience, as well as many of the concepts in this book, remains relevant today. With numerous illustrations and examples, the book includes practical advice to the teacher on planning, conducting, and evaluating educational experiences. The book includes specific chapters on color use, use of various media, and use of the textbook as a classroom technology.]

Ely, D. P., & Plomp, T. (1996). *Classic writings on instructional technology.* Englewood, CO: Libraries Unlimited.
[This collection of foundations in the field of instructional technology includes 17 seminal works from authors such as Skinner, Gagne, Dale, Keller, and others. From defining the field and developing theories to design, development, evaluation, and consideration of delivery options, the collection includes previously published papers which are commonly used in instructional technology courses.]

Ely, D. P., & Plomp, T. (2001). *Classic writings on instructional technology* (Vol. 2). Englewood, CO: Libraries Unlimited.
[The second volume of this collection of foundational works includes 15 seminal papers from authors in instructional technology including Jonassen, Heinich, Clark, Kozma, and others. Building on the first volume, the collection describes the field of instructional technology through definitions and history, design and development functions, media delivery options, and the profession itself. Each section includes an introduction which describes specific developments in the section topic and references omitted papers which are important to the field.]

Fleming, M., & Levie, W. H. (Eds.). (1978). *Instructional message design: Principles from the behavioral and cognitive sciences* (1st ed.). Englewood Cliffs, NJ: Educational Technology Publications, Inc.
[This book provides research-based principles of message design concerning perception, memory, concept-learning, and attitude-change. The second edition (1993) revised previously presented principles in light of the shift in research from a behavioral emphasis to a cognitive orientation and added chapters on motivation, psychomotor, and problem-solving.]

Gagne, R. (1985). *The conditions of learning and theory of instruction* (4th ed.). New York: Holt, Rinehart and Winston.
[In this book and subsequent editions Gagne identifies different types of learning (e.g., chains, concepts, rules, etc.) that evolved over the multiple editions. He describes internal and external conditions for each of the different types of learning that instructional designers should address in the instructional materials. This book also describes the nine events of instruction defined by Gagne.]

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: computer conferencing in higher education. *The Internet and Higher Education, 2*(2–3), 87–105.
[The authors present a template based on the community of inquiry model to analyze text-based communication in higher education. Three core elements are presented in the template: teaching presence, social presence, and cognitive presence, which are used to assess educational approaches and strategies in creating a community of inquiry.]

Garrison, D., & Shale, D. (1987). Mapping the boundaries of distance education: Problems in defining the field. *American Journal of Distance Education, 1*(1), 7–13.

[Garrison and Shale examine the definition of distance education provided by Keegan (1986) and argue that the components too narrowly define the field. The authors suggest a less restrictive view and instead provide a minimum set of criteria for distinguishing distance education from other areas.]

Glaser, R. (1990). The reemergence of learning theory within instructional research. *American Psychologist*, 45(1), 29–39.

[In describing how experimentation in instruction is beneficial to developing learning theories, the author discusses proceduralized knowledge and skills, self-regulatory skills, and structured knowledge for problem-solving. The paper includes a discussion of integration of learning theories and how that integration can benefit knowledge and skill development.]

Heinich, R. (1984). The proper study of instructional technology. *Educational Communications and Technology Journal,* 32(2), 67–87.

[In this award winning article, the author discusses the need for more scholarly activity and research within the field of educational technology. He argues that the focus of this scholarly activity should shift from education to technology which would allow a greater focus on methods, processes, tools, and techniques.]

Jonassen, D., & Grabowski, B. (1993). *Handbook of individual differences, learning, and instruction*. Hillsdale, NJ: Lawrence Erlbaum.

This book concerns the differential psychology of learning and instruction. The authors describe individual differences and the ways learning is impacted. Research on aptitude-by-treatment interaction is presented to explain how learners may respond differently to instruction. Although the authors explain it is not feasible to design instruction according to individual differences, awareness of differences may allow educators to understand potential difficulties for certain learners.

Jonassen, D. H. (2004). *Handbook of research on educational communications and technology.* Mahwah, NJ: Lawrence Erlbaum.

[Sponsored by the Association of Educational Communication and Technology (AECT), the third edition of this handbook includes 56 chapters which summarize research relevant to the application of communication and information technologies in education. The handbook is divided into sections including foundations, strategies, technologies, models, design and development, and methodological issues. A valuable introduction to the field of educational technology, this handbook serves as an indispensible reference tool for students, faculty, and practitioners.]

Keegan, D. (Ed.). (1993). *Theoretical principles of distance education*. New York: Routledge.

[This edited book presents five differing perspectives on the theory of distance education: didactic, academic, analytical, philosophical, and technological, as analyzed by 15 scholars in the field.]

Keegan, D. (1996). *Foundations of distance education* (3rd ed.). London: Routledge-Falmer.

[Keegan provides an introduction and overview to distance education by presenting the origins and backgrounds, as well as a thorough analysis of the various definitions. Additionally, theories of distance education are explored in addition to various models of distance education around the world.]

Keller, F. S. (1968). Goodbye teacher … *Journal of Applied Behavior Analysis, 1*, 79–89.

[This article provides the basis for Keller's personalized system of instruction. The personalized system of instruction presents a method for converting traditional classroom instruction into an individualized format that has been successfully implemented in a variety of disciplines beyond psychology. It has been suggested as a viable model that can be adapted for use in distance education.]

Knowlton, J. Q. (1966). On the definition of "picture". *AV Communication Review, 14*(2), 157–183.

[In this seminal article, Knowlton focuses on the design of signs for communication. In his analysis of signs, he introduces the term referent category, which is the "thing" for which signs are substituted. Knowlton then distinguishes between two types of signs, iconic and digital signs. Finally, iconic signs are divided into realistic, analogical, and logical pictures.]

Kozma, R. B. (1994). Will media influence learning? Reframing the debate. *Educational Technology Research & Development,* 42(2), 7–19.

[The author responds to Clark's (1983) assertion that media does not facilitate learning. The paper discusses the role of media in learning and the methods employed including how media interact with cognitive and social processes. Using two media-based projects as examples, the paper describes particular circumstances where media can influence learning.]

Kulik, C., & Kulik, J. (1985). *Effectiveness of computer-based education in colleges*. Paper presented at the American Educational Research Association, Chicago, IL. (ERIC Document Reproduction Service No. ED263890).

[This article presents a meta-analysis of 101 computer-based education studies, which found that computer-based education usually had positive effects on college students. A relationship was found between achievement outcomes and study duration, control for instructor effects, and publication source.]

Kulik, C.-L. C., & Kulik, J. A. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computers in Human Behavior, 7*(1–2), 75–94. doi: 10.1016/0747-5632(91)90030-5.

[Kulik and Kulik updated their previous meta-analysis of computer-based education with a follow-up meta-analysis of 254 computer-based instruction (CBI) studies in light of computer advancements. Consistent with earlier findings, CBI raised student examination scores by 0.30 and had the strongest effect when the length of treatment was 4 weeks or less.]

Levie, W. H., & Lentz, R. (1982). Effects of text illustrations: a review of research. *Educational Communications and Technology Journal*, 30(4), 195–232.
[Describing 155 experiments including 7,182 subjects which compare learning using illustrated text and learning using text only, the authors consider whether illustrations facilitate learning with text. The paper includes summaries of related research using nonrepresentational materials (maps, diagrams, etc.), learner-created drawings, and mental imagery for learning and as well as a discussion of how illustrations can affect learning.]

Houghton, H. A. & Willows, D. M. (Eds.), *The psychology of illustration*: *Vol. 1. Basic research* (pp. 51–85). New York: Springer.
[This book provides five chapters that summarize the research on pictures from different perspectives. Levie provides a broad review on the effectiveness of pictures. Levin, Anglin, and Carney provide a scheme for classifying the use of pictures. Pressley and Miller consider the use of pictures with children. The fourth chapter by Peeck examines the role of illustrations in processing and remembering text. The final chapter by Winn summarizes the research on charts, graphs, and diagrams in instruction.]

Markle, S. M. (1969). *Good frames and bad: A grammar of frame writing*. New York: Wiley.
[This book presents detailed information on a variety of behavioral strategies for teaching facts, concepts, and rules using programmed instruction. Markle also presents a number of rules for designing good instruction.]

Markle, S. (1975). They teach concepts, don't they? *Educational Researcher, 4*(6), 3–9. doi: 10.3102/0013189X004006003.
[In this article, Markle discusses the appropriate strategy to teach a concept, mainly to provide an accurate definition of the concept, along with representative examples and nonexamples. She establishes that most instructional designers do a poor job of not only defining terms but also providing solid examples to aid learners in concept acquisition.]

Merrill, M. D., Tennyson, R. D., & Posey, L. O. (1992). *Teaching concepts: An instructional design guide*. Englewood Cliffs, NJ: Educational Technology Publications, Inc.
[This book instructs how to design and develop instructional materials to teach concepts. The authors describe five procedures in teaching concepts: (1) definition, (2) presentation of examples and nonexamples, (3) attribute isolation for each example and non example, (4) opportunity for practice, and (5) assessment by classification.]

Postlethwait, S. N., & Hurst, R. N. (1972). The audio-tutorial system: incorporating minicourses and mastery. *Educational Technology*, 12(9), 35–37.
[An interesting precursor to today's online learning systems, the paper describes a pilot program utilizing an audio-tutorial system. Benefits of this method include the ease of distributing content from "good" teachers as well as the flexibility

to tailor an individual learning experience for each student. The method is time-consuming, however, and students must be responsible for their own progress. The authors suggest that this technology could provide a viable alternative to "going to college."]

Reigeluth, C. M., Bunderson, C. V., & Merrill, M. D. (1978). What is the design science of instruction? *Journal of Instructional Development, 1*(2), 11–16.
[The authors discuss instructional science as a prescriptive design science and then describe three major phases of instructional development—design, production, and validation—as well as three approaches to each. Typical activities of those involved in instructional science, such as scientists, technologists, and technicians, are presented followed by a four-stage theory-construction procedure for practitioners to derive and validate prescriptive principles and instructional theories. The article concludes with a discussion of basic vs. applied research.]

Rickards, J. (1979). Adjunct postquestions in text: A critical review of methods and processes. *Review of Educational Research, 49*(2), 181–196. doi: 10.3102/00346543049002181
[Rickards describes potential processes that might be produced by adjunct postquestions (mathemagenic activity), those that are either a forward or backward direction and are either general or specific. He then discusses various methods for assessing the processes.]

Rothkopf, E. Z. (1970). The concept of mathemagenic activities. *Review of Educational Research, 40*(3), 325–336.
[The concept of mathemagenic activities ("activities that give birth to learning") is explained, first by defining the concept, describing the four forms of mathemagenic activities. Reading, also described as a Class III activity, is broken into three actions: translation, segmenting, and processing. Rothkopf concludes with a discussion of the practical consequences for incorporating mathemagenic activities into instructional materials.]

Slavin, R. E. (1987). Mastery learning reconsidered. *Review of Educational Research*, 57(2), 175–213.
[The author reviews the literature on the application of mastery learning techniques in elementary and secondary school settings and the effect mastery learning techniques on achievement. The review shows that there is currently no evidence that mastery learning can accelerate achievement.]

Sweller, J., van Merrienboer, J. J., & Paas, F. G. W. C. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, 10(3), 251–295.
[The authors describe cognitive load theory and consider the implications to instructional design. Starting with a detailed description of human cognitive architecture including working memory, long-term memory, and schema construction, the authors consider how instructional material can best be presented to maximize learning. The paper includes a discussion of various effects such as worked examples, split attention, modality, and redundancy.]

Tripp, S., & Bichelmeyer, B. (1990). Rapid prototyping: an alternative instructional design strategy. *Educational Technology Research & Development*, 38(1), 31–44.

[Rapid prototyping, a concept common in software engineering, can serve as a model for instructional design. The authors compare the similarities between instructional design and software design and describe an example where rapid prototyping is used to create a computer-based tutorial.]

Wittrock, M. C. (1974). A generative model of mathematics learning. *Journal for Research in Mathematics Education*, 5(4), 181–196.

[The author presents the learning of mathematics as a cognitive process and describes a generative model of mathematics learning based on experience and empirical studies. The author suggests that future research should focus on the intellectual processes of students learning mathematics.]

Wittrock, M. C. (1989). Generative processes of comprehension. *Educational Psychologist*, 24(4), 345–376.

[Presenting a model of the generative processes of reading comprehension, the author describes generation, motivation, attention, and memory and considers relevant related empirical research. The author offers principles for teaching using generative processes of comprehension and describes examples to support real-world use of the model.]

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