Lisa C. Yamagata-Lynch

Activity Systems Analysis Methods

Understanding Complex Learning Environments

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To my mother and grandmother who have always been my role models and who have always supported me unconditionally.

Preface

The purpose of this book is to introduce Cultural Historical Activity Theory (CHAT) and activity systems analysis to researchers and practitioners interested in studying complex learning environments. CHAT is a theoretical perspective within the field of psychology that originated in Lev Vygotsky's work in Russia during the mid-1920s to mid-1930s. Since Vygotsky's work there have been a growing number of European and North American scholars who became interested in this perspective when examining complex learning environments. Activity systems analysis is one method developed by Yrjö Engeström for analyzing human interactions with CHAT by identifying human activity as the unit of analysis.

For the purpose of this book, I define complex learning environment as situations in natural settings where multiple individuals are involved in shared activities within a single or multi-organizational context. My discussions in this book describe how to study these environments from a CHAT perspective specifically using activity systems analysis. I will include a brief theoretical overview on CHAT, the value of activity systems analysis in research and practice, examples of studies using this method, and methodological issues for readers to consider when designing and implementing future studies. It is my goal to provide readers with information that they can use as a guide when engaging in studies involving activity systems analysis.

The first goal of this book that is addressed in Chap. 1 is to highlight the benefits that activity systems analysis brings to studies involving complex learning environments. I will describe how activity systems analysis can enhance traditional qualitative investigations. This methodology can provide a means to systematically analyze human interaction while considering how an individual or group of individuals and their interactions with the environment affect their activities.

The second goal, which is addressed in Chap. 2, is to present background information on Vygotsky's work and the work of post-Vygotskian CHAT scholars. This information will benefit readers when designing and engaging in investigations from this theoretical perspective. While what I present in this book will not provide an exhaustive detail of the theoretical discussions, I will present canonical works related to CHAT and activity systems analysis that readers can use as a starting point for identifying further readings. In this discussion, I will introduce ideas of authors who have contributed both to the theoretical and methodological developments in CHAT. The theoretical information will center on the works of Vygotsky

(1986, 1978), Leontiev (1974), and other contemporary CHAT scholars. The methodological information will focus primarily on Engeström's (1987, 1993, 1996, 2001) work on activity systems analysis. I will explain how CHAT scholars approach complex learning situations and how activity systems analysis can be used for understanding human interactions.

The third goal, addressed in Chap. 3, is to address the criticisms against activity systems analysis while discussing the challenges related to conducting investigations from a non-dualist perspective. CHAT scholars identify themselves as non-dualist theorists; however, there are challenges in maintaining this position because the mainstream methods for studying human activity are entrenched with dualist language (Packer 2000) and CHAT researchers to date have not successfully identified a series of non-dualist analytical methods. This creates a common phenomenon in CHAT study reports where the theoretical framework may take a non-dualist ideal position, but when it comes to data analysis and data presentation researchers are unable to move away from dualistic analytical methods and language (Sawyer 2002). Thus, in several CHAT studies there is a dissonance between the theoretical framework, analysis, and discussion of findings. As a developing framework, this is unavoidable; however in order to contribute to further methodological developments in CHAT, researchers and practitioners need to discuss how they try to maintain their theoretical commitments when they confront methodological dissonance in their work (Yamagata-Lynch 2007).

The fourth goal is to provide in-depth examples of studies that relied on activity systems analysis to examine complex learning environments. Chapter 4 introduces seven studies and how the authors used activity systems analysis in their work. Chapter 6 provides a discussion surrounding an in-depth examination of one of my own studies with data collection instruments, sample data sets, analysis, and discussion of findings.

The fifth and final goal of this book, which is addressed in Chap. 5, is to provide an overview of general qualitative research methodologies that are critical for conducting a sound study using activity systems analysis. It is important to note that most research using activity systems analysis are qualitative in nature and do not necessarily provide generalizable findings. In order to use this method to document human activities that take place in natural settings, researchers need to be able to design and conduct trustworthy qualitative research. I will discuss the basic methodological issues for maintaining trustworthiness; however, a fair amount of resources exist on this topic. Therefore, I ask the reader to engage in further readings of well-established qualitative research methods handbooks and books for further information.

Why Discuss CHAT Methodologies?

In North America, educational researchers and practitioners since the late 1980s have become more interested in pursuing theoretical paradigms that capture complex learning environments. CHAT is one of several theoretical frameworks that

became popular because it provides a method for researchers to understand and describe the interaction between individuals and the environment in natural settings. Russian scholars initially developed CHAT in the 1920s to reformulate psychology as a science that studied human activity as an interaction-based holistic engagement between individuals and their environment.

After a couple of decades of books published on CHAT by prominent North American authors such as James Wertsch, Michael Cole, and Barbra Rogoff , reputable journals such as the American Psychologist, Educational Psychologist, and Educational Researcher that are targeted for a wide-range of audience have recently included articles on CHAT. In these articles, CHAT has been referred to as social constructivism, sociocultural theory, or activity theory. Many of these discussions have contributed to the theoretical development in understanding CHAT and have translated Russian theoretical concepts into English.

In these existing literatures, much of the discussion dwells on the theoretical background of CHAT and the description and interpretation of human interactions from this perspective; however, there is a lack of discussion on methodological guidance for researchers and practitioners on how to engage in investigations of complex learning environments from this perspective. This can be problematic because the lack of methodological discussions makes it difficult for CHAT newcomers to explore the possibilities of using this theoretical framework in their work. Furthermore, it makes it difficult for the existing CHAT community to develop a set of agreed-upon, trustworthy methodologies that can ensure that their investigations will help provide viable insights. Future theoretical developments for explaining complex human activity can be limited if CHAT scholars do not actively discuss methodological issues.

Understanding the methods involved in activity systems analysis can be a challenging task for many North Americans. There are several reasons for this difficulty. First the original texts of CHAT are in Russian. Numerous authors have reported on the difficulties of reconciling translation problems of the works of original authors such as Vygotsky and Leontiev. Second, in North America activity systems analysis has deviated from the Russian scholars' and Engeström's original works, using it to identify tensions to overcome and bring about sociopolitical change in participant practices. Therefore, there are different versions and intensities for engaging in activity systems analysis investigations. Third, there are currently numerous publications on the theoretical background of activity theory and studies reporting the results of using activity systems analysis for analyzing qualitative data sets, but there have been no publications on research methodologies and how researchers engage in activity systems analysis.

Why Activity Systems Analysis?

Activity systems analysis is a popular methodology among CHAT scholars who work with data from complex learning environments and map human interactions in natural settings. This method became well known after Engeström's (1987)

original conception and the wide circulation of his work through the publication of Cole and Engeström (1993) and Engeström (1993). Since then, there have been several applications of activity systems analysis in qualitative research as a descriptive tool to (a) capture the processes involved in organizational change (Barab et al. 2004; Engeström 1993, 2000; Yamagata-Lynch and Smaldino 2007), (b) identify guidelines for designing constructivist learning environments (Jonassen and Rohrer-Murphy 1999), (c) identify systemic contradictions and tensions that shape developments in educational settings (Barab et al. 2002; Roth and Tobin 2002), and (d) demonstrate historical developments in organizational learning (Yamagata-Lynch 2003b). While the application of activity systems analysis in North America has, focused on descriptive applications, Engeström's work has focused on using this method in work settings to bring about change in participant practices (Engeström 1993, 2001, 2008).

The advantage for using activity systems analysis is that it provides new methods for researchers and practitioners to extract the essence of complex data sets in a graphic model that they can communicate with others. Researchers and practitioners can compare one human activity based data set with another while drawing systematic implications. These methodological advantages for using activity systems analysis can help researchers organize their analysis with a valid framework while building reliable interpretation of their data and minimize the overwhelming task of analyzing and making sense of complex data sets from real world settings.

Who is this Book for?

I have written this book for researchers, practitioners, and graduate students who are interested in conducting investigations of complex learning environments using qualitative research methods and who are interested in conducting their investigations using activity systems analysis. I want to provide information that will help readers design and conduct investigations, and for graduate students to design, conduct, and complete their dissertations. Ultimately, the reader needs to decide how to design and conduct their work, but it is my hope that this book will provide a starting point for their work with CHAT.

This book is also for readers who are struggling to come to terms with how to work with complex learning environments whether they use activity systems analysis or not. There is a growing number of scholars who choose to investigate educational phenomenon in natural settings. At the same time, these scholars often find themselves paralyzed in the data analysis of naturally occurring complex phenomena and struggle to make meaningful interpretations. While, activity systems analysis alone cannot solve all of the complicated issues that real-world data presents, it can help investigators by brining a systematic framework in their iterative emergent data collection and analysis while they identify systemic implications.

For example, in a 3 year study, which I will discuss in-depth in Chap. 6, I used activity systems analysis in a qualitative study to follow interactions between selected teacher activities within a school district and a technology professional

development program. Over the duration of the study, I was able to conduct a systematic analysis of how the activities of the professional development program, participating teachers, and non-participating teachers affected changes in the teachers' and school district's technology integration activities. I presented these changes in distinct activity systems with accompanying narratives that explained how the interactions between the participants and the environment in which the activities took place shaped the nature of their activities over time.

The ideas I introduce in this book are based on what I learned by reading works of many authors before myself and through experiences from conducting educational studies from a CHAT perspective using activity systems analysis. I ask the reader to take the information I offer as one source among works of many others. It is my hope that this book will help readers use CHAT to design and conduct research on real-world complex learning environments.

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Contents

Chapter 1
Activity Systems Analysis and Its Value

Keywords Cultural Historical Activity Theory (CHAT) • Activity theory • Activity systems analysis

The goal of this chapter is to highlight the benefits that activity systems analysis brings to studies involving complex learning environments. In this chapter, I will address these questions:

- What is activity systems analysis?
- What is the added value that activity systems analysis brings to qualitative research?
- Who studies complex learning environments with activity systems analysis?

By the end of the chapter, readers will be able to identify the benefits activity systems analysis could bring to their future work.

What is Activity Systems Analysis?

Activity systems analysis is a methodology that spawned from Cultural Historical Activity Theory (CHAT) that can be valuable for qualitative researchers and practitioners who investigate issues related to real-world complex learning environments. This analysis method is designed to enhance understanding of human activity situated in a collective context (Engeström 1987; Kaptelinin 2005) and is graphically represented by a series of triangle diagrams. This method can guide researchers and practitioners in their design, implementation, analysis, and development of conclusions in a research study or in a program evaluation. It supports a systematic and systemic approach to understanding human activities and interactions in real-world complex environments. It can help researchers and practitioners understand individual activity in relation to its context and how the individual, his/her activities, and the context affect one another. Additionally, it can help document the

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historical relationships among multiple activities by identifying how the results from a past activity affect new activities.

An activity system is represented as a triangular model that was developed by Engeström (1987) and shown in Fig. 1.1. In this model, the *subject* is the individual or groups of individuals involved in the activity. The *tool* includes social others and artifacts that can act as resources for the subject in the activity. The *object* is the goal or motive of the activity. The *rules* are any formal or informal regulations that in varying degree can affect how the activity takes place. The *community* is the social group that the subject belongs to while engaged in an activity. The *division of labor* refers to how the tasks are shared among the community. The *outcome* of an activity system is the end result of the activity.

The contextual systemic contradictions and the nature of each individual component in an activity system can create *tensions* within a system. Systemic contradictions exist beyond the instance of a single activity; but they also exist within the context of the activity. Tensions arise from the influences that systemic contradictions have on an activity and can affect the interactions between components in an activity system. Tensions can affect the subject's ability to attain the object by taking a role as an obstacle, making it difficult for the subject to attain the object, or by taking a role as an enabling influence for the subject to attain the object.

For example, the activity system represented in Fig. 1.2 portrays what many U.S. school district superintendents experienced during late 2008. This sample activity is based on the *New York Times* article "*Fuel Prices Squeeze School Districts*" by Pat Wiedenkeller published on September 7, 2008. The article described how superintendents nationwide made choices regarding school operational budget adjustments when the dollar amount that was allocated for the 2008–2009 school year did not account for rapidly rising fuel costs. Wiedenkeller described how organizational budget decisions were influenced by multiple stakeholders and multilayered activities. In order to present a sample activity systems analysis of a familiar situation, I examined the story from the following research question: how does the rising fuel cost affect school districts' ability to provide educational services to students?

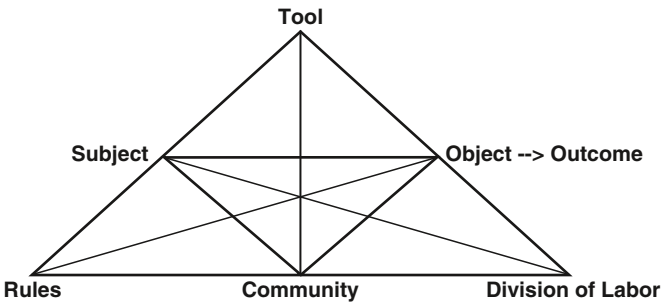

Fig. 1.1 Engeström's activity system (adapted from Engeström (1987))

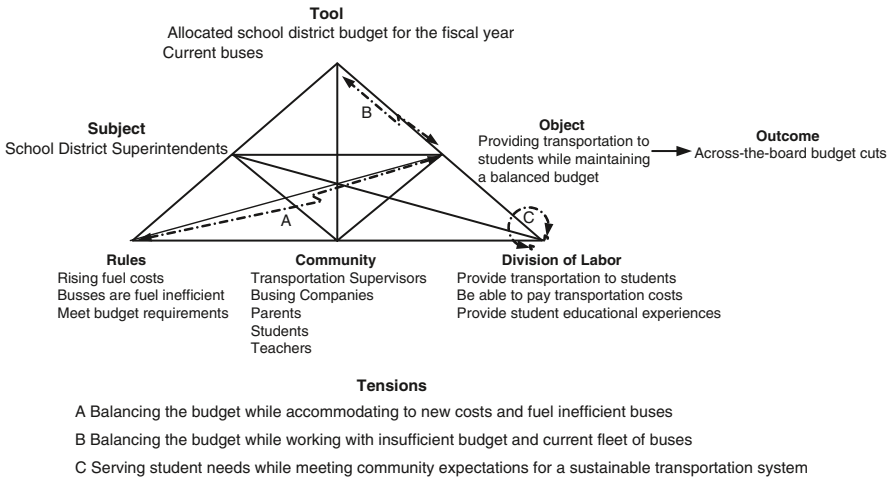

Fig. 1.2 Superintendent activity in "Fuel Prices Squeeze School Districts"

The story can be examined by interpreting how changes within a context can create systemic contradictions that introduce tensions to future activities and affect the outcomes of those activities. In Fig. 1.2 based on the newspaper article, the *subject* is the school district superintendent. The article describes a situation in which the superintendent, who needs to maintain a balanced budget, is confronted by a systemic contradiction – an unexpected significant rise in expenditures for school district operations that the budget cannot accommodate. The superintendent's *object* is to provide students with transportation while maintaining a balanced budget for district operations. The primary *tool* in this activity is the predetermined budget allocated to the school district. Another *tool* is the current fleet of buses, which is quickly transforming into an ineffective tool because of the new gas prices. The *rules* in this activity include (a) rising diesel fuel costs from the previous year's $2.96 per gallon to $4.26 per gallon, (b) buses used in many school districts nationwide get 6 miles to the gallon, and (c) the previously allocated budget requirements. The *community* members in this activity that are mentioned in the article include school district transportation supervisors and busing company personnel. It is also safe to include parents, students, and teachers in the community because the outcomes of this activity can affect their school-related activities. The *division of labor* in this activity within the community is negotiating transportation costs, providing students with transportation, and not overspending the budget.

Figure 1.2 represents how changes in a contextual situation that create systemic contradictions can create tensions in individual activities and affect the nature of those activities. The tensions in this activity were triggered by the systemic contradiction related to dramatic changes in the entire school district context as a result of unexpected school operations expenditures. The new rules based on this

systemic contradiction required superintendents to modify their transportation activity because the allocated budget was inadequate and the buses had became considerably less effective tools. This brought a severe strain on the division of labor of the activity while superintendents attempted to provide transportation to students and other educational experiences.

As a result, the systemic contradiction affected the rule, tool, and distribution of labor components of the activity system by introducing tensions. *Tension A* between the rule and object represents how superintendents nationwide at the time of this story were struggling with their operational budgets because the rules that they were relying on regarding fuel costs changed dramatically compared to the previous year, and the current fleet of buses that many school districts used were fuel inefficient. *Tension B* between the tool and the object shows that it was difficult for many superintendents to balance their budgets because the previously allocated district budgets did not anticipate the increased fuel costs and the only resources they had to work with were the buses to which they had access. *Tension C* represents a circular tension within the division of labor component. This tension demonstrates how superintendents need to provide transportation to students, pay transportation costs, and at the same time provide educational experiences to students. Superintendents needed to execute all of their responsibilities in the division of labor following the unexpected constraints on the allocated budget.

The *outcome* of this activity was across-the-board budget cuts. These budget cuts have resulted in eliminating field trips and after-school buses and consolidating bus routes. The article, provided on the *New York Times* website, mentions that some schools were beginning to explore using more fuel-efficient compressed-natural-gas-powered buses. Some school districts were purchasing their own buses because they could run buses more economically than through contracts with busing companies. At the teacher and student activity level, school districts were encouraging teachers to engage students in virtual field trips on computers rather than leaving the schools on buses.

Figure 1.3 represents how the outcome from the previous superintendent activity affected an instance of students' school related activity. In this activity students were the *subject* with the *object* of "go to school." The *tool* was consolidated bus routes and no bus services in some locations. The superintendent's activity is represented as a small triangle linked to the tool component of this activity because the outcome of the superintendent decision for across-the-board budget cuts was what lead to fewer bus services. The *rule* enforced by the budget cut was a decrease in bus services. The *community* members in this activity were superintendents, parents, and students. The *division of labor* for the superintendent and parents were providing transportation to students to attend school. The tensions students experienced were *Tension A* getting to school while accommodating to decreased bus services, and *Tension B* getting to school with consolidated bus routes, or no bus services. The *outcome* that students experienced in this activity was ride bus on a new route and walk to school if their bus route was eliminated.

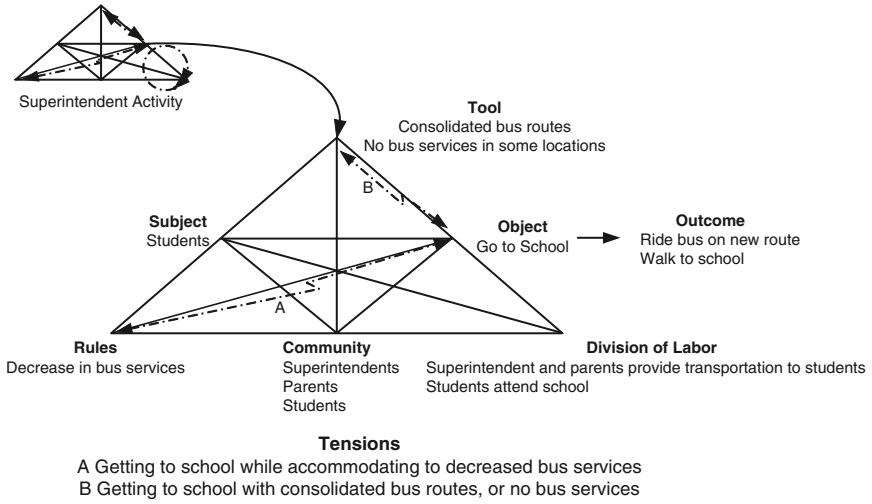

Fig. 1.3 Student activity affected by superintendent activity

The activity systems analysis can continue with other subjects. For example, an analysis of teacher activities may show that teachers have fewer opportunities for taking their students to field trips. They will have to reconcile the tension between providing students with experience-based rich learning opportunities while working with a smaller budget for field trip transportation. As another example of a possible subsequent activity, the *New York Times* article noted that some superintendents were deciding not to fill new teaching positions in order to save money. A teacher from this type of school district may find increased class sizes and decreased student access to classroom resources, changes that will affect the nature of teachers' and students' daily classroom experiences.

What is the Added Value that Activity Systems Analysis Brings to Qualitative Research?

The main advantage to incorporating activity systems analysis in qualitative research and program evaluation is that this method can help investigators make sense of complex real-world data sets in a manageable and meaningful manner. It provides a valid framework to use as a guide while building reliable interpretations of the data. In this data analysis process, activity systems analysis can provide opportunities for investigators to (a) work with a manageable unit of analysis, (b) find systemic implications, (c) understand systemic contradictions and tensions, and (d) communicate findings from the analyses. I will discuss details to these advantages below.

Manageable Unit of Analysis

As demonstrated in the example of superintendents struggling with budget allocations, real-world human experiences involve a complex, intertwined knot of variables that cannot be easily separated into mutually exclusive variables. When these complex experiences are separated into variable units they lose the richness that is involved in real-world activities. However, when investigators do not separate these experiences into manageable units of variables it is difficult to make meaningful inferences from the situation.

Activity systems analysis provides a new method to extract meaningful information from massive and complex qualitative data sets and to conceptualize how real-world phenomena are entrenched within the situation that is being examined. The unit of analysis in this method is the human activity itself embedded within its social context (Engeström 1987; Rogoff 1995; Wertsch 1991; Wertsch et al. 1995). This unit of analysis embraces the belief that real-world activities cannot be isolated into variables.

For example, in the analysis of the superintendent activity in Fig. 1.2, I used the activity systems framework as a guide to identify the superintendent activity and its outcomes within the context and the critical variables that were affecting the entire activity. In this analysis, my purpose was to capture the data that would allow the reader to analyze the situation in its entirety. This approach can help identify solutions that take into account how the entire situation would react and affect outcomes of future activities.

To ensure that investigators identify the appropriate unit of analysis, they need to carefully examine the critical activities related to the study questions (Yamagata-Lynch 2007). It is likely that investigators will engage in drafting and redrafting their activity systems as they continue their data analysis. During this refining process, investigators need to ask themselves whether the set of activities they identify are going to help them answer their study question and whether they are able to find systemic implications from their findings.

Systemic Implications

Once a trustworthy unit of analysis is identified and investigators begin to draft multiple activity systems that are relevant to their study, they can begin identifying the relationship between one activity and another to draw out systemic implications. Investigators need to zoom in and out in their analysis to examine both single and multiple units of activity to find systemic implications. In this process, investigators may find that their interpretations of a single unit that they already identified may need to be reconceptualized after examining a series of activities.

For example, Fig. 1.4 shows a simple case of how superintendents' activity in Fig. 1.2 and students' activity in Fig. 1.3 are related to one another. The across-the-board budget cut from the superintendent activity changed the nature of the student activity getting to school. I have not illustrated how other activities would be

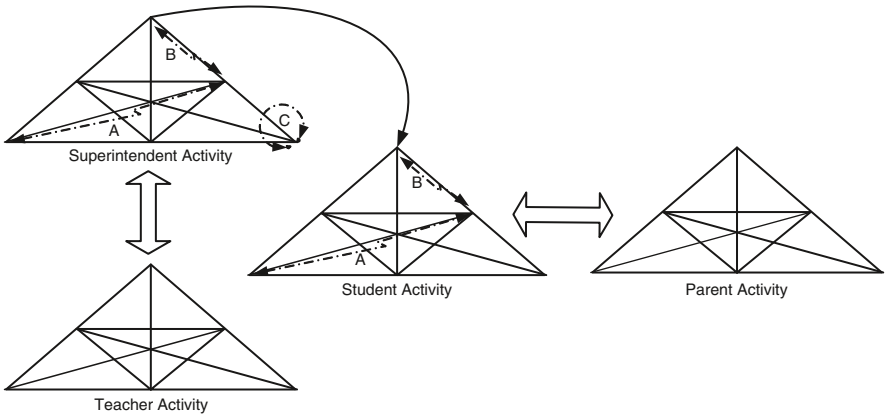

Fig. 1.4 Systemic relations between sample activities

affected, but it is easy to imagine that the superintendent and student activities are going to have an impact on transportation and classroom activities initiated by parents and teachers.

This type of systemic analysis within qualitative methods is often difficult to achieve while managing complex data sets. The data collection and analysis process in qualitative research can be overwhelming, and the analysis methods often lack a systemic reference point to engage in a comparative process of the relationship between the themes. In activity systems analysis, each activity unit identified in the analysis can be used as a reference point for further systemic analysis, as demonstrated in Fig. 1.4.

The traditional units of analysis in qualitative research have been the trustworthy themes that emerge from the investigator's observations and the resulting analysis of primarily text-based data such as interviews, observations, and existing documents. Qualitative investigators use their emerging study question and their participant experiences as a lens to identify the prevalent themes and findings in their work. In this process, themes are categorized into sub-themes, but this is often done based on the relationship of the observed themes within the context of the study question and not necessarily the relationships between the observed themes themselves. In my own CHAT work, I have engaged in the thematic qualitative analysis as described above in addition to the systemic analysis with activity systems. Therefore, qualitative thematic analysis is systematic, but it is not necessarily designed to reveal systemic implications.

Understanding Systemic Contradictions and Tensions

Systemic contradictions and tensions that influence a series of related activities can reveal how human beings modify and create new activities while adapting to the environment when their experiences trigger transformations of objects and the environment itself (Scribner 1997). Systemic contradictions and tensions are inherent in human activities and do not occur accidentally or arbitrarily (Engeström 1996).

Systemic contradictions and tensions influence human activity by bringing pressures that can encourage development, stunt development, or become the reason for changing the nature of an activity (Engeström 1993).

For example, in the superintendent activity in Fig. 1.2 in response to the systemic contradiction Tension A (balancing the budget while accommodating to new costs and fuel inefficient buses), school district superintendents were driven to reallocate their budgets for school operations. In order to provide students with transportation while balancing the budget, superintendents had to make drastic changes to the way they had planned to distribute monies for district-wide operations. This necessity for change resulted in across-the-board budget cuts, which then affected students' school transportation activity in Fig. 1.4.

By identifying systemic contradictions and tensions that affect multiple activity systems, investigators are able to demonstrate and discuss how contextual changes within complex human activities can bring new pressures to the subjects' activities. Investigators can discuss how systemic contradictions and tensions can drive transformations in future activities and portray how human activities are tied to several complex phenomena in a natural setting rather than predicting a causal relationship between observed behavior and isolated variables.

Communicate Findings

Understanding human interactions in real-world complex learning environments often involves complicated data collection, analysis, and presentation methods, which can make communicating findings from these investigations difficult (Collins et al. 2004; Hoadley 2004). It can be challenging for researchers to manage the overwhelming amount of information generated in these types of investigations (Collins et al. 2004). It can also become difficult for researchers to coordinate multiple levels of necessary analyses for arriving at meaningful conclusions of their work (Cobb et al. 2003).

Activity systems analysis provides a framework for investigators to not only conduct their analysis of complicated real-world human interactions, but a method for communicating the results of their analysis. By using this method, researchers and practitioners are able to anchor their analysis and discussion of their data sets based on the units of activity identified in the analysis. This enables them to engage in conversations about their data in a manageable and meaningful manner.

For example, throughout the discussions in this chapter I have frequently referred to the superintendent activity in Fig. 1.2 and the student activity in Fig. 1.3. Each activity represented by the triangle model and accompanying narrative description represented an essence of the complicated nature of the human activity related to the school district budget and student transportation. Figure 1.4 represents both superintendent and student activities and how they contributed to systemic implications relative to other school district activities. Therefore, the triangle models in Figs. 1.2 and 1.3 served as visual and conceptual tools representing both the superintendent and student activities to help present and communicate the new information for readers to interpret in Fig. 1.4.

Who Studies Complex Learning Environments with Activity Systems Analysis?

Since the wide circulation of Cole and Engeström (1993) and Engeström (1993) in North America, Western researchers have applied activity systems analysis to various situations in education and corporate settings for both theoretical research purposes and practical problem-solving purposes. Table 1.1 summarizes a representative collection of works published in English since the 1990s. Table 1.2 lists the full references of the works cited in Table 1.1.

Table 1.1 Past work using activity systems analysis

Nature of work	Example of works
Understanding developmental work research	
Engeström introduced Developmental Work Research (DWR) to the North American educational research community. The purpose of DWR is to develop interventions for participants' specific situations using activity systems analysis and engage in an evaluation of the solution	Engeström (1993) Engeström (1996) Engeström (2000)
Describing real-world learning situations	
These works are based on empirical investigations in educational settings using activity systems analysis as a descriptive tool for understanding the complex learning activities being studied and how the participants and context are coevolving within the situation being studied	Barab et al. (2002) Barab et al. (2004) Yamagata-Lynch (2003b)
Developing new research methods	
In these works the authors explore how activity systems analysis can help researchers develop new analysis and reporting methods that can capture the rich interaction between the participants and their context, and how these interactions are molding the situation	Engeström (1999b) Yamagata-Lynch (2007)
Designing human–computer interaction systems	
These authors believe that using the information processing model has its limits in identifying necessary design features of human–computer interfaces. They introduce and demonstrate how activity systems analysis can better address the complex interactions between the human agent and the computer interface as a tool	Gay and Hembrooke (2004) Kaptelinin and Nardi (2006) Mwanza (2002a) Nardi (1996)
Exploring theoretical concepts	
These authors are interested in exploring the theoretical aspects of activity theory and clarifying concepts by using examples from empirical work. These works are relevant to practical work because it brings new insights for how to use activity systems in practice and makes it a stronger model	Cole and Engeström (1993) Engeström (1987) Foot (2002) Kaptelinin (2005) Nardi (2005)
Planning solutions to complicated work-based problems	
These authors work do not meet the criteria for DWR, but use activity systems analysis for understanding complicated real-world problems in work settings and developing solutions to those problems	Marken (2006) Yamagata-Lynch and Smaldino (2007)

Table 1.2 Works cited in Table 1.1

Barab, S. A., Barnet, G. M., Yamagata-Lynch, L. C., Squire, K., & Keating, T. (2002). Using activity theory to understand the systemic tensions characterizing a technology-rich introductory astronomy course. *Mind, Culture, and Activity*, *9*(2), 76. doi: 10.1207/S15327884MCA0902_02

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Engeström, Y. (1999b). Expansive visibilization of work: An activity-theoretical perspective. *Computer Supported Cooperative Work, 8*(1–2), 63–93. doi: 10.1023/A:1008648532192

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Engeström, Y. (1996). Developmental work research as educational research: Looking ten years back into the zone of proximal development. *Nordisk Pedagogik, 16*(3), 131–143

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Foot, K. A. (2002a). Pursuing an evolving object: A case study in object formation and identification. *Mind, Culture, and Activity*, *9*(2), 132–149. doi: 10.1207/S15327884MCA0902_04

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Table 1.1 details categories that reflect the authors' intent for using activity systems analysis in their work. These categories include (a) describing real-world learning situations, (b) developing new research methods, (c) understanding Developmental Work Research (DWR), (d) designing human–computer interaction systems, (e) exploring theoretical concepts, and (f) planning solutions to complicated work-based problems. Many of these works will be introduced as examples of activity systems analysis research in Chap. 4 and in other chapters that discuss theory and methodological aspects. When examining Table 1.1 it will become apparent that there is no agreed-upon method for using activity systems analysis; however, reading these works will help readers understand how activity systems analysis can be used in different settings and how the various authors' works have contributed to the development of this methodology.

Researchers and practitioners who choose to use activity systems analysis in their work are attracted to this method because it can help them describe how human activity and the setting in which it is situated co-evolve over time and change the nature of future activities while participants deal with new barriers and new possibilities. There are some investigators who use this method to identify new solutions to existing problems, then trace how the new solutions affect future activities and the existing setting. Within the context of human–computer interaction, investigators use this method as a flexible design tool to identify system-wide solutions and anticipate new problems that their product may bring to real-world contexts. Finally, there are investigators who are focused on the theoretical implications of this methodology and contribute to defining the parameters of the key theoretical concepts that can define how researchers and practitioners can use this method.

Chapter 2
Understanding Cultural Historical Activity Theory

Keywords Lev Semenovich Vygotsky • Post-Vygotskian scholars • Cultural Historical Activity Theory (CHAT) historical background

This chapter will focus on the contributions of Lev Semenovich Vygotsky and post-Vygotskian scholars who played a critical role in the development of Cultural Historical Activity Theory (CHAT) and the emergence of activity systems analysis. I will begin with a discussion of the historical background that is related to the CHAT literature. Then I will introduce theoretical concepts that are critical for researchers and practitioners to understand before they can successfully design and use activity systems analysis in their investigations or program evaluations involving complex learning environments. Finally, I will discuss how Yrjö Engeström developed activity systems analysis as a research methodology within CHAT.

Reading and Understanding CHAT

The origins of CHAT have been tied to 1920s' Russian scholarship. Many CHAT sources were initially published in Russian; and many North American scholars, including myself, who engage in investigations using the CHAT framework, are building their knowledge on translated versions of the original texts. As individuals who are competent in more than one language are aware, translating text from one language to another is difficult. Not all cultural innuendos can be expressed in translated text format and before readers can fully appreciate what an author is trying to communicate in text-based communications they need to have some understanding of the cultural experiences of the author.

Reading translated versions of the original works on CHAT can at times be frustrating. This is because once investigators dive into this literature they will find multiple translations with slightly different interpretations of critical works in the

L.C. Yamagata-Lynch, *Activity Systems Analysis Methods: Understanding Complex Learning Environments*, DOI 10.1007/978-1-4419-6321-5_2,

original Russian. For example, Leontiev's work on defining object-oriented activity has been published in English as Leontiev (1974, 1978, 1981). They are all based on the same work published originally in Russian in 1972 in Voporsy filosofili, No. 9, pp. 95–108. The multiple English versions indicate that there have been several attempts to translate the original work. Working with multiple translations of the same work may make it difficult for non-Russian speaking researchers and practitioners to comfortably cite the original sources. For this reason, it is important for researchers to clearly articulate in their work which version of a translated text they are citing, and, if possible, acknowledge that there are different interpretations to some of the CHAT concepts and clarify which interpretation the researcher chose to use in their work.

There are several excellent journals for North American researchers to learn about CHAT. The *Journal of Russian and East European Psychology*, formerly known as *Soviet Psychology*, is an excellent source for Russian authors' work translated to English. *Mind, Culture, and Activity* is a quarterly journal published in English on contemporary CHAT research. *Human Development* is another English language journal that has had special issues on CHAT.

North American scholars need to gain a perspective on historical events in Russia during the 1920s when CHAT originated to understand how history affected its theory development. North Americans do not share the same cultural history with Russian scholars and reading original works within its historical context will help them better understand the arguments presented in the foundational works. For example, North Americans, accustomed to freedom of speech and academic freedom, would find it difficult to imagine that their work would be subject to censorship, much less that an individual's life may be at stake depending on what s/he chooses to study. Additionally, it is important for North Americans to be mindful and pay attention to how the names of Russian scholars are spelled. In some cases there are multiple versions of how a single Russian author's name is spelled. For example Leontiev is spelled "Leontiev," "Leont'ev," and "Leontyev." It is also important to check the first initials of Russian scholars. In several instances there are multiple generations within a family that pursue a research career in psychology.

Vygotsky and CHAT

Lev Vygotsky was a Russian Jewish scholar who lived through the 1917 Soviet Revolution (also called the Bolshevik Revolution, the Russian Revolution, or the October Revolution). He worked closely with A. N. Leontiev and A. R. Luria in Moscow from 1924 to 1934 until, after a 10-year battle with tuberculosis, he died at the age of 37. Vygotsky worked at a time when significant historical events in Moscow lead to hectic and confusing times. Many of his works were not accessible to North American researchers until the 1960s because they were subject to censorship by the Soviet government.

Vygotsky was one of several post-revolution scholars who was asked by the new government to reformulate psychology, incorporating Marxist philosophical principles (Wertsch 1985a). During this time, many psychologists could not reach a consensus on appropriate subject matter for psychological research and appropriate methodologies for studying psychology as a science (Bozhovich 2004). In their work, Vygotsky and his colleagues took a critical view of the history of psychology in order to develop a new and comprehensive approach to human psychological processes (Luria 1979).

Following the charge set forth to him by the government, Vygotsky based his psychology on Marxian theory to describe the relationship between individuals and their social environment (Cole 1985; Wertsch 1985b). He used Marx's political theory regarding collective exchanges and material production to examine the organism and the environment as a single unit of analysis. Through this reformulation of psychology, Vygotsky attempted to capture the co-evolutionary process individuals encounter in their environment while learning to engage in shared activities (Stetsenko 2005).

Most scholars who are interested in any type of psychological phenomenon are familiar with the 1920s and 1930s work of Russian psychologist Ivan Pavlov on physiology and how it led to the development of the behaviorist movement. Classical conditioning, a behaviorist theory, became a popular and viable approach for explaining animal and human psychology. Undoubtedly, Pavlov's work played a critical role in the behaviorist movement in psychology around the world. While witnessing the growing popularity of Pavlov's work, Vygotsky became concerned that psychologists were taking a one-sided approach to examining, interpreting, and understanding human psychology (Kozulin 1990; Vygotsky 1986).

In reaction to Pavlov's work, some Russian psychologists began to separate themselves from other scientific fields that relied on associationism. They began to define psychology as a science that treated the organism and the environment as two disembodied entities that were connected through stimulus and response relationships (Scribner 1997). Associationism brought many psychologists an opportunity to shed the pseudo-science label with which it had been burdened. They transformed their work into a more credible form of science by following the scientific method in their study of observable behaviors. Associationism provided psychologists with an organizing framework to identify variables that they could manipulate and conduct hypothesis testing in controlled settings and move away from the formerly prominent introspectionist methods.

Vygotsky did not agree with the mainstream movement toward transforming psychology into a scientific field by separating the organism and the environment. He argued that psychologists needed to develop a unified framework that supported objective study of human consciousness (Galperin 1992; Luria 1979). In this unified framework, the organism and the environment were parts of a complex system that co-created consciousness through human participation in activities (Vygotsky 1978). He was interested in identifying methods that would objectively study and explain human activities.

Vygotsky took an approach in psychology that recognized the essential relationship between an individual's mental processes and that individual's interaction with cultural, historical, and institutional settings (Rogoff 1990; Wertsch 1991; Wertsch et al. 1995). He believed that psychology ought to become a scientific field that studied the relationship between the organism and the environment and how it enabled the development of human consciousness. He was concerned that if scholars systematically ignored this relationship they would not be able to understand how consciousness was formed.

Mediated Action

Vygotsky introduced mediated action as a concept to explain the semiotic process that enables human consciousness development through interaction with artifacts, tools, and social others in an environment and result in individuals to find new meanings in their world. Vygotsky assumed that relationship among artifacts, tools, and social others were not constant and that they changed over time (Vygotsky 1987). The interactions in which individuals engage allow opportunities for mediated action that contribute to the social formation of their consciousness (Wertsch 1985b). In this interaction, individuals are not passive participants waiting for the environment to instigate meaning-making processes for them, but, through their interactions, individuals make meaning of the world while they modify and create activities that trigger transformations of artifacts, tools, and people in their environment (Scribner 1997).

Mediated action involves an interaction between the individual and mediating artifacts/tools and signs, a semiotically produced cognitive tool, that resulted from the interaction. While explaining human speech development as a mediational process involving thinking and speech, Vygotsky proposed that signs were impressions made on individuals while interacting with artifacts/tools, and these impressions assisted individual speech development as well as consciousness (Vygotsky 1987). Signs do not have concrete physical existence in the environment, but they serve as a byproduct of the interaction between individuals and artifacts/tools to mediate thought processes (Vygotsky 1978).

Figure 2.1 represents what is often referred to as Vygotsky's basic mediated action triangle (Cole and Engeström 1993). The *subject* in this graphic is the individual or individuals engaged in the activity. The *mediating artifact/tool* can include artifacts, social others, and prior knowledge that contribute to the subject's mediated action experiences within the activity. The *object* is the goal of the activity. Signs are not represented in the basic triangle, but are assumed to be an artifact of the mediated action process. This triangular representation of mediated action was Vygotsky's attempt to explain human consciousness development in a manner that did not rely on dualistic stimulus–response associations.

Human activity is a process that involves artifacts that act as technical tools and signs that act as psychological tools available in the social environment

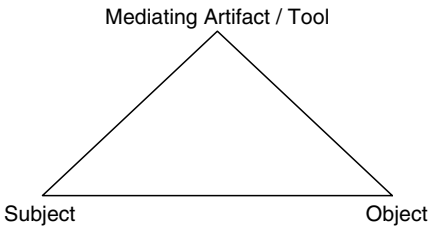

Fig. 2.1 Vygotsky's basic mediated action triangle (adapted from Cole & Ergestiön (1993))

(Wertsch et al. 1993), and this process contributes to the formation of individual consciousness within an evolving environment. Mediated action is viewed as a means of interpersonal communication through the interactions among subject, tool, sign, and object while the subject develops new signs that help them make meaning of the world (Kozulin 1996). Once a sign materializes, the subject can transform the sign into an artifact or a cultural tool by the way in which s/he decides to continue to use and share the sign. There is not a clear moment when an artifact transforms into a cultural tool, but a cultural tool is an artifact that has gained value within participants' activities rather than as a temporary tool for engaging in an immediate activity.

Recently, there has been a fair amount of philosophical debate regarding the use of the word "object" due to translation problems. The Russian word "object" has multiple meanings when translated into English. It has been used interchangeably to refer to the goal of an activity, the motives for participating in an activity, and material products that participants try to gain through an activity. This has created confusion among CHAT scholars regarding what object-oriented activity means (Nardi 2005). What CHAT scholars do agree about is that the "object" is the reason why individuals and groups of individuals choose to participate in an activity (Kaptelinin 2005), and it is what holds together the elements in an activity (Hyysalo 2005).

As a methodologist, I do not see it as part of my work to redefine the "object." To be clear in this book, object-oriented activity refers to mediational processes in which individuals and groups of individuals participate driven by their goals and motives, which may lead them to create or gain new artifacts or cultural tools intended to make the activity robust. In this process, there is no guarantee that the activity will become robust. In fact, at the conclusion the activity may collapse and become unsustainable.

Mediated Action and Internalization

Vygotsky used the concept of internalization to explain how individuals processed what they learned through mediated action to develop individual consciousness through social interactions. In his explanation of internalization, he stated:

> Every function in a child's cultural development appears twice: first, on the social level, and later, on the individual level; first *between* people (*interpsychological*), and then *inside* the child (*intrapsychological*) (Vygotsky 1978, p. 57).

Vygotsky referred to internalization as a concept that explained how individuals developed their own consciousness. Vygotsky has been criticized for introducing internalization to CHAT because it is based on a dualistic language, which is contradictory to how he explained mediated action and it can over simplify mediated action into an input and output process.

Vygotsky's efforts to reconcile the disembodied treatment of the organism and the environment may have been a bold attempt in the 1920s and 1930s, but his arguments themselves were not free from binding dualistic language. Current researchers and practitioners need to be aware of this and be honest about how CHAT as a field has not eliminated dualistic language in its theory development and we are still working to identify how to better explain human activity with a nondualist framework. For example, Galperin on numerous occasions has vehemently argued that, despite Vygotsky's attempts to rid the divide between the organism and its environment, "the external remained external, and the internal remained internal" (Galperin 1992). Furthermore, by using internalization as a theoretical concept within CHAT, Vygotsky overemphasized the transformations that individuals experienced and did not sufficiently address the individual's influence on the transformations of the social environment (Matusov 1998). As a result, a criticism of the Vygotskian method of CHAT analysis of human activity is that it became too person-centered and did not adequately address cultural evolutions.

Mediated Action in Zone of Proximal Development

Vygotsky used the concept of zone of proximal development (ZPD) as a metaphorical tool to explain the potential learning of children while collaborating in problem solving activities with an adult or peer. The well known definition of ZPD presented in *Mind in Society* is:

> It is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers (Vygotsky 1978, p. 86).

Vygotsky believed that a child's intellectual development ought to be examined during problem-solving activities. Vygotsky introduced his participants to problem-solving activities in laboratory settings to examine the interactions that took place between interpersonal activities that involved social others and intrapersonal activities that involved only the individuals.

It should be noted that ZPD is one of the major legacies of Vygotsky's work in the social sciences. In North America, the concept of ZPD is frequently referred to as a pedagogical tool to justify instructional strategies in classrooms. In these applications, it is often separated from the CHAT perspective and instead referred to as an artifact or in some cases as a variable that educators can manipulate.

However, ZPD from a CHAT perspective is a conceptual tool for understanding the complexities involved in human activity while individuals engage in meaning making processes and interact with the environment. ZPD was a concept introduced in Vygotsky's later works shortly before his death, and he did not live to fully develop the implications (Wells 1999). Therefore, according to Wells, even though the ZPD is a provocative metaphor, there are times that its applications by Vygotsky himself are somewhat contradictory with the rest of his theory.

For example, in *Thought and Language* (Vygotsky 1986), Vygotsky provided an example of an assessment situation to clarify his explanation of the ZPD. In the example, he described the ZPD as a numerical value based on measured problem-solving scores of a child while collaborating with a peer minus the same child's problem-solving score working alone. This application of the ZPD promotes its use as a numerically based variable for assessing student performance. However, it is not necessarily a measurable numerical entity.

By using the ZPD as a metaphor, Vygotsky attempted to eliminate the unidirectional relationship he himself created between the organism and the environment in his internalization process. The ZPD is where the interpersonal and intrapersonal activities blend and fuse and no longer exist as different entities. Vygotsky was attempting to move away from viewing individual consciousness as a commodity that grew within an individual; instead he viewed it as a shared embodiment between individuals and their environments, including social others.

Vygotsky used the ZPD as a metaphorical tool for elaborating how interactions between individuals and their environments, including objects and social others, took place. Prior to Vygotsky's work, psychologists examined individual intelligence based on battery tests that reflected the intellectual ability of individuals at the time of the test. In real life problem-solving situations such as in schools, children engage in learning activities while in cooperation with social others (Vygotsky 1978). However, Vygotsky did not clearly articulate this concept to establish how the relationship between the organism and the environment dynamically evolved (Engeström 1987).

Post-Vygotskian CHAT Theorists

With the rising power of Joseph Stalin in the Soviet Union in the late 1920s, it became difficult for Vygotsky and his colleagues to continue their work on mediated action that focused on explaining human consciousness. After Vygotsky's death in 1934, the Soviet government banned his work on intelligence and the study of consciousness (Wertsch 1985b). Even before Vygotsky's death, Luria and Leontiev were pressured to leave Moscow and abandon the study of mental activity (Prawat 1999).

In the early 1930s, Luria and Leontiev moved to Kharkov, a town in the Ukraine, and were joined by local psychologists, including P. Galperin and P. Zinchenko. Together they formed the Kharkov school of developmental psychology, and

referred to themselves as the Kharkovites (Kozulin 1990). Due to political pressures and fear of maintaining their careers and lives, the Kharkovites purposefully shifted the focus of their work on human activity as a topic of study in psychology to be better accepted by the Soviet government.

The Kharkovites reexamined Vygotsky's writings, identified their work as activity theory, and introduced analytic categories for examining the interactions between the organism and the environment (Scribner 1997). Activity theory was originally developed during the early twentieth century by S.L. Rubinshtein, independent of Vygotsky's work, as a philosophical and psychological theory (Brushlinskii 2004). The Kharkovites extended Rubinshtein's work by focusing on the psychological aspects and treating activity as a holistic unit of analysis directed by an individual or groups of individuals' goals and motives for participating in an activity (Davydov 1999; Galperin 1992; Leontiev 1974). In this process, they broadened the scope of Vygotsky's mediated action by introducing human activity as the unit of analysis that is distributed among multiple individuals and objects in the environment (Zeek et al. 2001). Vygotsky's mediated action is often explained as a process, but human activity from an activity theory perspective is a series of processes that is contained within an activity that acts as a bounded system.

Dealing with the Problems Brought Forth by Internalization

To rectify the internal/external problem in mediated action, Galperin introduced the concept of "orienting activity" (Stetsenko and Arievitch 1997). Galperin (1989) explains mental activity as the ability that allows human beings to explore, examine, and predict potential results of actions they were preparing to initiate. This mental activity provides subjects with an abbreviated experience of the activity prior to the physical enactment. Galperin interpreted mental activity as an opportunity for subjects to consider and weigh the potential consequences prior to enacting the activity itself (Prawat 1999), and provided an elaboration of sign functions in human activity.

This internal mental activity orients the subject to the external physical activity, and once the subject experiences this orienting nature of the mental activity, it has already served its purpose. Hence, mental activity itself does not exist separate from observable physical action, but is part of the psychological content of an action and serves the purpose of a sign in mediated action. Indeed, psychologists can examine the psychological and physical actions separately, but by doing so they fail to encapsulate the complex nature of activity in its psychological and physical entirety.

Post-Vygotskian researchers attempted to overcome the problems brought upon by the internalization metaphor by identifying the unit of analysis in activity theory as human activity itself, which inherently included both mental activity and observable activity. In a lecture for a child psychology course at Moscow State University, D.B. El'konin, cited in El'konin (1993), made note of this relationship between meaning (mental activity), behavior (external activity), and the subject:

> Human action with objects has two aspects. It contains human meaning as well as an operation aspect. If you omit meaning, it ceases to be an action, but if you void it of the operational and practical aspect, then too, nothing remains of it… Thus, these two aspects already exist within the unit of human behavior, and that unit of human behavior is a purposeful, conscious action. Moreover, these must be seen as two aspects as well, not as different spheres of the world having nothing to do with one another (p. 23).

Activity Theory

Contributing to the development of activity theory, Leontiev identified object-oriented activity as the unit of analysis that activity theorists are interested in examining. Object-oriented activity involves interaction among subject, object, motivation, action, goals, socio-historical context, and the consequences and activity (Davydov 1999; Galperin 1992; Lazarev 2004). Leontiev (1974)[1] defined object-oriented activity as:

> …a molar and nonadditive unit of a material subject's life. In a narrower and more psychological sense, activity is a unit of life mediated by mental reflection whose real function is to orient the subject to the world of objects. Activity is thus not a reaction or a totality of reactions, but rather a system possessing structure, inner transformations, conversations, and development (p. 10).

Leontiev explained consciousness development as a self-regulated meaning making process driven by goals and motives in which individuals or groups of individuals choose to participate. This includes both mental and physical enactments of the activity that are interlaced throughout an individual's meaning making process. Within an activity, the events that occur and the consequences the participants experience can qualitatively change the participant, his/her goals and motives for participation, the environment, and the activity itself (Kaptelinin 2005; Rogoff 1995).

Activity emerges through a reciprocal process that transforms the subject, the object, and the relationship between the two and their context (Davydov 1999; Rogoff 1995). Additionally, the activity itself holds cultural formations with its own structures (Engeström and Miettinen 1999; Leontiev 1974). Once an activity is institutionalized, it becomes a robust and enduring tool within the culture (Cole and Engeström 1993).

Leontiev provided a clear distinction between object-oriented activity and goal-directed actions. Goal-directed actions are much more temporary in nature and may be a step that subjects take in the process of participating in an object-oriented activity. Goal-directed actions often are individually focused and have less of a collective consequence to the community-based object-oriented activity (Leontiev 1974), and may be a means for individuals or groups of individuals to participate in the object-oriented activity.

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[1] In this article I have used the translation published in 1974 in *Soviet Psychology*.

The work of Leontiev and his colleagues' focused on explaining and understanding from a psychological perspective how mental and observable activity can be regarded as a single unit of analysis, and how the interaction between the two affected both the individual and the environment. Leontiev's definition of activity allowed researchers to explain human learning as series of object-oriented activities and move away from mentalist approaches (Bedny and Harris 2005; Lazarev 2004). His work provided a framework in psychology that did not treat the organism and the environment as isolated entities (Galperin 1992; Rozin 2004).

This position has been passed on to a new generation of Russian CHAT scholars and is represented in the work of A.A. Leontiev and D.A. Leontiev, A.N. Leontiev's son and grandson, and V. P. Zinchenko (Leontiev 1981b, 1995; Zinchenko and Leontiev 1995). In these authors' work, we find a continual struggle to overcome the divide between the organism and the environment by treating mental activity as a process that orients subjects toward enacting a physical activity and coupling both as an element of the activity as a whole.

Engeström's Activity Systems Analysis and CHAT

Engeström (1987) further developed analytical methods within activity theory by introducing activity systems analysis. Activity systems analysis is used to map the co-evolutionary interaction between individuals or groups of individuals and the environment, and how they affect one another. It extends mediated action as a model of human activity that accounts for sociopolitical situations (Cole 1996). It specifically addresses both the individual and the environment in order to move away from former CHAT methods that were too person-focused.

The unit of analysis in activity systems analysis is the object-oriented activity itself (Engeström 1987; Rogoff 1995; Wertsch 1991; Wertsch et al. 1995). Furthermore, when conducting research based on activity systems analysis, examining individual behavior is the entryway for researchers to vicariously experience their participants' activities (Yamagata-Lynch 2003b). Through this experience, researchers can identify activities critical to answering their research questions and examine the collective meaning making processes (Yamagata-Lynch 2007).

As introduced in Chap. 1, Engeström's (1987) activity systems model is represented as a triangle diagram. The top triangle – Vygotsky's original mediated action triangle – signifies the *subject* that may be an individual or groups of individuals, the *tool* that may be social others and artifacts, and the *object* that can be the goal or motive of the activity represented. Artifacts that function as tools are not conveniently handed to the subject. They are invented, purchased, discarded, and replaced in the activity (Engeström and Middleton 1996). Therefore, subjects may discover new tools across multiple activities and the value of a tool may change over time as they engage in new activities. The *rules*, *community*, and *division of labor* components add the socio-historical aspects of mediated action that

were not addressed by Vygotsky (Engeström 1999a). As described in Chap. 1, rules refer to formal or informal regulations that can, in varying degrees, constrain or liberate the activity and provide to the subject guidance on correct procedures and acceptable interactions to take with other community members (Engeström 1993). The community is the social group with which the subject identifies while participating in the activity. The division of labor refers to how the tasks are shared among the community. All of the above components of activity systems, including Vygotsky's triangle and the bottom socio-historical components described in Chap. 1 can mediate change that may lead to an outcome not only for the object but also for each other (Engeström 1993).

Human activity can trigger tensions caused by systemic contradictions (Cole and Engeström 1993; Engeström 1987, 1993). These tensions arise when the conditions of an activity put the subject in contradictory situations that can preclude achieving the object or the nature of the subject's participation in the activity while trying to achieve the object. In some cases, the activity may collapse altogether and the subject may not be able to attain the object. In other cases, subjects may attain the object but be dissatisfied about how they attained the object.

Three Generations of Activity Theory

Engeström (1996, 2001) described three generations of activity theory research as distinct approaches to activity theory. He refers to Vygotsky's identification of the mediated action triangle as first generation activity theory. Second generation activity theory is attributed to A.N. Leontiev's work that emphasized the collective nature of human activity, along with Engeström's own work in 1987 that developed the activity systems model. Finally, Engeström refers to third generation activity theory as applications of activity systems analysis in developmental research where the investigator often takes a participatory and interventionist role in the participants' activity to help participants experience change.

Many studies in the United States using activity systems analysis have primarily focused on the descriptive nature of second-generation activity theory, and used activity systems analysis as a supplementary tool in qualitative research. In these studies investigators chose not to take an interventionist position, but instead used activity systems analysis as an analytical tool for understanding complex human learning situations that can be observed in natural settings. Scholars who do not necessarily identify themselves as CHAT scholars have completed many of these works, but consumers of this methodology found the benefits it brings to their work. These works have provided valuable insights into how activity systems analysis can be applied as a methodology within social science research and practice. However, many CHAT scholars now encourage investigators to engage in new work within an interventionist framework using third generation activity theory.

Identifying Bounded Systems for Activity Systems Analysis

Engeström (1999b) suggests that activity theory researchers and practitioners need to examine interactions shared among multiple activities and the boundaries of those activities to identify the potential development and changes in both human activity and societal systems. In order to engage effectively in these types of studies, investigators need a framework that will help them identify boundaries within complex systems. This boundary identification framework will guide the investigators' design, development, implementation, and analysis processes.

Identifying bounded systems from real-world complex human activity and its context can become difficult and unmanageable. When engaging in my own work, in addition to the typical activity theory bounded systems including object-oriented activity and goal-direction actions, I rely on activity settings and the three planes of sociocultural analysis to identify units of bounded systems in my data set. As a theoretical tool, activity settings provide frameworks for identifying bounded contexts in which the object-oriented activities and goal-directed actions that investigators observe take place. The three planes of sociocultural analysis is a theoretical tool that provides a framework for investigators to identify bounded units of activity based on the subject who is engaging in the object-oriented activity or goal-directed action. I will provide a discussion on both activity settings and the three planes of sociocultural analysis below.

Activity Settings

Activity settings are bounded systems related to the social environment in which object-oriented activities and goal-directed actions are anchored with other related activities with similar objects (Gallimore and Tharp 1990). It is the setting that provides the context in which activities take place (Tharp and Gallimore 1988). Activity settings are an inseparable component of human cognitive action (Rogoff 1990) because they influence the types of activities subjects will potentially encounter. Investigators are able to bind the contextual information that is most relevant and essential in a data set by identifying activity settings through an interpretive process.

By identifying activity settings, investigators will be able to describe the relationship between participant activities and the social environment without being overwhelmed with contextual information that may be irrelevant to their studies. Thus, activity settings allow investigators to interpret how participant activities are influencing and are being influenced by the social context (Rogoff 1990; Wertsch et al. 1995). In this process, investigators will find how activity settings, object-oriented activity, and goal-direction actions are fluid, intertwined, and changing from moment to moment (Lave 1993).

Three Planes of Sociocultural Analysis

The three planes of sociocultural analysis, which consist of the personal, interpersonal, and institutional/community planes, rely on the subject of an activity to identify bounded systems of activity (Rogoff 1995). The individual is the subject of activities that take place in the personal plane. The subjects of activities that take place in the interpersonal plane consist of groups of individuals engaging in collaborative initiatives. Community-based collective global activities are the subject of activities that take place in the institutional/community plane. Each of these planes can help identify object-oriented activities and goal-directed actions into units of bounded systems. In activity systems analysis, the object-oriented activities under investigation still remain to be the unit of analysis, but the subject of that activity can be an individual, group of individuals, or an organization.

Out of her concern that CHAT scholars often become overwhelmed in the analysis process of their work, Rogoff (1995, 1998) suggests that during investigations they ought to zoom into one plane of analysis at a time and blur out the other two planes. Blurring out is not equivalent to ignoring. Blurring consists of identifying the salient features of the planes that are not being examined but are essential and relevant to the study to help further appreciate the complex activities that take place on the zoomed-in plane of analysis. Thus, investigators can avoid making data analysis in CHAT research needlessly complex by clarifying, for themselves and their reader, which plane of analysis they are examining in their study.

Summary in Relation to Activity Systems Analysis Research Design

My goal for this chapter was to describe three key concepts that will help researchers and practitioners to successfully proceed with their work using activity systems analysis. This summary will provide the reasons investigators using this methodology need to understand specific concepts within CHAT before engaging in an activity systems analysis research and how these concepts can guide future research or evaluation design and implementation.

First, researchers and practitioners interested in using activity systems analysis need to understand mediated action and how Vygotsky used it as a concept for describing human activity and bidirectional relationship with the environment. Researchers and practitioners have to understand how Engeström used mediated action as a foundational concept while formulating his activity systems model. Activity systems analysis is a method to capture multi-mediational processes in human activity (Engeström, 1987, 1999a, b). Therefore, while engaging in activity systems analysis, investigators need to develop questions that will address mediational activities. Investigators then need to design the data collection methods to specifically capture information that will enlighten them about their participants' mediational processes.

Second, researchers and practitioners need to understand what object-oriented activities and goal-directed actions are from a CHAT perspective and be able to identify them in activity systems units. Activity systems do not present themselves in observed data sets in a neat and organized manner. Once investigators begin their data analysis, they will find that their data set is messy and complex. Through an interpretive process, investigators need to immerse themselves with the data and identify the multi-mediational activities their participants' experienced. In this messy process, investigators have to parse their raw data into object-oriented activity and goal-directed action units.

Finally, researchers and practitioners need to understand how to identify bounded systems in their data sets when engaging in activity theory studies. While identifying these bounded systems investigators must ensure that the process does not oversimplify or overcomplicate participant experiences. Interpreting data involving real-life interactions in a natural setting can be overwhelming because the information that is relevant and essential to the study and that which is not are all in the data set. Therefore, conceptual tools such as activity settings and the three planes of sociocultural analysis are helpful when investigators are parsing the data set into units of bounded systems.

Chapter 3
Activity Systems Analysis Critics

Keywords Activity theory critical reviews • Complexities involved in activity systems analysis

In this chapter I will discuss several valuable critical reviews of activity theory and activity systems analysis and how future investigators need to address. The criticisms include issues related to the comprehensiveness of activity theory as a theoretical framework, the complexities involved in understanding and conducting activity systems analysis, and the problems associated with using human activity as a unit of analysis in research. While engaging in this discussion, I will rely on the works of Toomela (1996, 2000, 2008a, 2008b), Nardi (1996), Roschelle (1998), and my own work from Yamagata-Lynch (2003b). Examining critical reviews of activity theory and activity systems analysis will help researchers and practitioners develop further understandings of the theory and the methodology.

Analysis of Activity is Inadequate for Examining Human Psychology and Culture

Toomela engaged in a series of discussions in *Culture & Psychology* from 1996 to 2008. He provided an extensive argument redefining how Vygotsky defined "internalization" (Toomela 1996), the shortcomings of activity theory as a framework for examining human cultural and psychological phenomena (Toomela 2000, 2008b), and the differences between sociocultural and cultural historical theory (Toomela 2008a). Toomela's specific criticisms expressed in his 2000 and 2008b work were in response to Ratner's (2000, 2008) works that proposed activity theory as an effective methodology in cultural and psychological studies.

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Toomela's fundamental argument against activity theory is described as:

> …activity as a unit of analysis does not allow us to differentiate many qualitatively different psychological mechanisms that may underlie what is considered the same activity when viewed externally. Cultural–historical theory, founded by Lev Vygotsky, considers instead that – and explains why – sign meaning should be taken as a central unit of analysis. Sign (usually a word) is a dialectical unity of external, material and internal, ideal aspects of the mind. The unity of specifically human environment – 'culture' and individual psychological mechanisms can be studied through the analysis of sign meanings but not with the analysis of external activities alone. Activity theory, once separated from cultural–historical psychology, is a dead end in pursuit for an understanding of the human mind (Toomela 2000, p. 362).

Toomela (2000, 2008b) argued that activity theory as it is practiced in North America is an inadequate framework for identifying and understanding cultural and psychological phenomena because it did not follow Vygotsky's cultural–historical approach.

Toomela's series of criticisms assume that activity theorists focus their work on observable activities within cultural settings with no recognition of human cognitive processes and discontinued using Vygotsky's semiotic analysis methods. Activity theorists, especially those who identified themselves as sociocultural theorists in North America, made a mistake by shifting the unit of analysis in their studies to human activity and moving away from the analysis of semiotic mediation processes (Toomela 2000, 2008b). According to Toomela, this resulted in studies that ignored individual cognitive development and its relationship with human activity, cognition, psychology, and cultural settings. Toomela (2000, 2008b) suggest researchers and practitioners to follow Vygotsky's methods for analyzing sign meanings to understand cultural and psychological human development as a semiotically mediated process. This will help them avoid being trapped in unidirectional methods of analysis and interpretations.

As articulated in Chap. 2, Vygotsky's colleagues moved to Kharkov to continue their work and moved away from Vygotsky because it became increasingly difficult to stay in Moscow when Stalin was not in support of Vygotsky's work on human consciousness. However, contrary to Toomela's arguments, the Kharkovites did not move away from examining semiotic processes involved in mediated action. They expanded Vygotsky's work by identifying analytical boundaries for examining mediated action through object-oriented activity and making it possible to analyze how the organism and the environment maintain a co-evolving relationship. This is clearly articulated in second and third generation activity theorists' work especially those that follow and use Engeström's (1987, 1993) activity systems analysis methods because this analytical method captures both observable material tools and psychological tools such as signs and symbols. Each data-based activity systems model represents multiple mediated action processes that investigators can use as a guide to explain human activity as a complex coordinated experience shared and distributed among individual cognition, action, motivation, artifacts, cultural tools, social norms, local communities, and the greater cultural setting.

While addressing Toomela's criticisms, researchers and practitioners need to clarify how they define object-oriented activity as a series of mediated action and

conceptualize it as the unit of analysis in their work. In this discussion, most likely in the theoretical framework and methodology sections, investigators need to articulate Vygotsky's work as the origins of activity theory and help others understand mediated action as well as object-oriented activity. They need to clearly understand and communicate that activity from a CHAT perspective includes both observable experiences and mental activities (El'konin 1993, Galperin 1989, Prawat 1999, Stetsenko and Arievitch 1997).

Additionally, researchers and practitioners need to consistently use object-oriented activity as the unit of analysis in their investigations. They cannot assume that once they introduce the CHAT framework in the literature review they no longer have to address it in later sections of their work. They must use object-oriented activity as the unit for organizing and presenting data and findings. The data analysis needs to be an elegant showcase of series of mediated actions with accompanying narratives that affected participants' cognitive and observable experiences. The presentation of findings needs to address how this theoretical framework and methodology that involve using object-oriented activity as the unit of analysis enhanced the investigation.

Finally, researchers and practitioners need to be aware that activity systems analysis is a simplified method for presenting descriptive scenarios of observable participant behaviors. While participants' observable behaviors are the entry point to which investigators begin developing an insider perspective, the reader will not be able to gain a comprehensive perspective of the data without understanding the participants' cognitive processes. Thus, investigators need to vicariously experience the participants' observable and mental activities and share these experiences in the study report by portraying them with activity systems.

Activity Systems Analysis is Too Difficult to Learn

Nardi (1996) published one of the first extensive edited books in the United States on cultural historical activity theory (CHAT) within the field of Human Computer Interaction (HCI). She presented activity theory as a theoretical framework and activity systems analysis as a method for examining human computer real-world practices. One of the main intent of the book was to introduce activity theory as an alternative to traditional methodological frameworks in HCI. The 14 chapters are divided into three parts in the book and provide an introduction to activity theory, examples of how activity systems analysis has been used in HCI design, and new theory developments in CHAT. When this book was published, it successfully brought attention to activity theory and activity systems analysis within the HCI field, and resulted in scholars making contributions to subsequent books and journal article publications.

In one of the book chapter, Nardi shared her experience having a special issue proposal with a series of articles on activity theory for a major American HCI journal rejected because the editor believed that activity theory was difficult for the

reader to follow. The editor argued that in order for readers to understand this framework they have to invest a lot of time studying it. Furthermore, the editor did not find any evidence that activity theory was a worthwhile framework to use in empirical studies. Therefore, the editor was unsure whether the time spent on learning this framework would be worth the readers' effort and it was unclear to what if any the added value was compared to traditional frameworks in HCI research.

Contrary to this criticism the increasing complexity that activity theory introduces to qualitative research brings opportunities for researchers and practitioners to address rich real-world experiences. It can identify findings that encapsulate the entirety of the observed data and can avoid isolating it from the real-world context to which it was observed. Thus, the theoretical framework and the language of activity theory and activity systems analysis provide researchers with a perspective for organizing and communicating data about human interactions that other methodologies do not necessarily address.

This criticism points out how investigators need to clearly communicate key ideas of Vygotsky's work on mediated action and subsequent works by Russian scholars on activity theory when discussing activity systems analysis as a viable method for examining complex real-world human activities. To be successful at this, investigators need a thorough understanding of CHAT. Then they need to be able to select the key ideas that need to be communicated to the reader/audience to make activity systems analysis become relevant from their perspective within the context of the investigation. Then, investigators need to effectively communicate the meanings associated with subjects, tool, object, rules, community, division of labor, outcomes, tensions, and systemic contradictions within the mediated action framework and what role each component takes in the activity systems model.

Researchers and practitioners need to be proficient in qualitative research methods and engage in trustworthy data collection and interpretative processes. This will require data collection strategies that entail prolonged engagement in the participants' activity setting to gain an understanding of their experiences. Multiple data collection strategies need to be implemented that are triangulated to reach interpretive findings for the reader to become convinced that the data is trustworthy before being presented with the activity systems analysis.

Investigators need to summaries key ideas regarding activity theory and activity systems analysis, and a trustworthy qualitative data set so that the reader/audience is able to engage in their own analysis. This will help readers/audiences further understand the theory and the methodology. This will also help readers/audiences decide whether the author's work is trustworthy and applicable to their own context.

Finally, researchers and practitioners need to clearly state to the reader/audience what the added value is for engaging in activity systems analyses. Throughout a study report, the researcher needs to provide information to convince the reader that activity systems analysis is not simply an academic exercise, but a methodology that will bring benefits to the research and practice of their field of study. Researchers need to be purposeful in the way they present their theoretical framework, data analysis and discussion of findings so that they build a convincing argument of how activity systems analysis can improve research and practice in their field.

Activity Theory is not a Unifying Theory that is Generalizable and it does not Inform Practice

Roschelle (1998) prepared a book review of Nardi (1996) for *The Journal of the Learning Sciences*. His review not only provides a thorough critique of the book itself, but also addresses several issues regarding activity theory and activity systems analysis within the context of educational technology research and practice. He conducted his review to identify what new contributions activity theory and activity systems analysis bring to educational technology that other theories have not yet brought forth. His review of the book includes both criticisms and compliments, but in this section I will focus on the criticisms.

Roschelle (1998) indicates that several chapters in Nardi's book provide a good summary of activity theory with strong case studies of its use in HCI, but contrary to the claims that Nardi makes the edited volume does not successfully present activity theory as a grand unifying theory in HCI. He points out that the book introduces activity theory and activity systems analysis primarily applied in qualitative case studies that do not generate generalizable outcomes. Roschelle does not agree with Nardi's argument that by simply using activity theory in HCI research and practice and adopting a common vocabulary will result in investigators being able to make generalizable claims. Roschelle indicates that Nardi and other authors who contributed to the book did not provide an adequate discussion on how the use of activity theory in HCI have contributed to improving exiting designs and design processes of technology products. Instead the book provides an impression that activity systems analysis is a theoretical exercise with no implications to HCI practice.

Roschelle's criticisms are all valid. Activity theory is indeed a theoretical framework that is compatible with qualitative research investigations, and since its introduction to the United States in the early 1990s, activity systems analysis has been commonly used as a supplementary analysis in qualitative investigations. The analysis method is descriptive by nature, but it brings manageable units of analyses for investigating complex real-world human interactions. It helps to unpack the complexities involved in human activities and help researchers and practitioners to engage in discussions about their observations and findings. Therefore, I agree that findings that result from this method are not generalizable.

Additionally, I agree that not all research using activity systems analysis contribute to practice. When activity theory was adopted in North America most scholars, including myself, used it exclusively as a descriptive tool in qualitative studies and not as a method for changing practice. Engeström's original works have focused on changing practice, but most North American scholars did not initially embrace this aspect of the methodology. There is increasingly more encouragement from activity theorists outside the United States to use activity systems analysis for its original intentions to bring about change in practice.

When taking a CHAT perspective researchers and practitioners need to be aware and honest that their investigative goals are not to make generalizable claims in the traditional sense. Instead it is focused on what Stake (1995) referred to as petite

generalization that focus on the discussion of general findings within the case or cases being examined. Stake discusses how in qualitative case studies the goal is particularization and not grand generalizations. Through elaborations of individual cases, case study researchers provide how each case fits or do not fit established generalized claims related to the phenomena being investigated. Activity systems analysis aims for this particularization similar to case studies. Thus, the investigators' goal for engaging in activity systems analysis is to gain and share their understandings of complex human activities through particularization.

While making generalizable claims is not the goal of this methodology, in terms of future development areas, there is couple of possible methods for making the results from activity systems analysis apply to a larger context. The first method is for investigators to engage in more collaborative works that will allow them to use both quantitative and qualitative methods when studying complex real-world human learning situations. This may yield findings that can be applied to multiple contexts. Another method is for researchers and practitioners to reenact the implementation of their interventions in more than one setting to find whether there are common systemic implications they find in their activity systems analysis.

To address Roschelle's concerns that activity systems analysis does not necessarily contribute to the practice of design we need more researchers and practitioners who work together and take a practical theoretical approach. Practical theory is concerned with how theory and research can be applied to improve practice (Barge 2001). It is concerned in solving actual problems in practice rather than focus on the ability to understand, predict, and control events (Craig and Tracy 1995). These investigations involve an iterative process grounded in empirical studies that require researchers and practitioners to find new meaning to both theory and practice by applying abstract concepts to concrete situations through reflective discourse (Craig 1996). There is a lack of documentation in public forums on how such efforts are made through the use of activity systems analysis and how to improve design processes. Therefore, when researchers and practitioners engage in such collaborative projects they need to engage in a discourse with other members of their community regarding their methodologies and practical impact.

Activity Systems Analysis Limits the Ability to Understand Complex Human Interactions

In my own work, I have used activity systems analysis to conduct a qualitative study over three years to gain a historical understanding of interactions that took place at a rural school district surrounding a one year technology professional development program (Yamagata-Lynch 2003b). In the study I used this analysis method to identify the interactions between the activities of selected teachers who participated in the professional development and other activities within the school district. As a result, I analyzed the activities of the program, participating teachers, and non-participating teachers that led to changes in classroom and district level technology integration practices. I summarized the teacher and district activities in

a series of activity systems with accompanying narratives. The detail about this study is provided in Chap. 6.

Throughout this work I came to understand that while activity theory embraces the organic complexities involved in real-world human interactions, using activity systems analysis necessitates the investigator to simplify rich participant activities into representative snap shots (Yamagata-Lynch 2003b). The conceptual tools that this methodology brought to my work made it possible to identify manageable units of activities that multiple participants shared, and how those interactions brought systemic influences to participants. However, the triangle models that I prepared during the analysis made me draw summaries of my participants' experiences that were not as rich and complex as real experiences.

While drawing these snap shots, I found it very difficult to identify how to organize individual activity systems in a trustworthy and non-arbitrary manner. I drafted the activity systems diagrams based on findings from the qualitative investigation. However, when I began to draw the diagrams it became apparent that the real-world activities and the activity setting were far more complicated than what the triangle model can afford to capture. As a result, I became unsure of how to select which pertinent contextual information to include in the individual diagrams while maintaining a trustworthy interpretation and presentation of the changes that occurred in participant activities. In order to identify the contextual elements in the activity systems analysis, I included the recurring themes in the data set that participants reported affected their technology integration activities. Once I drew the series of diagrams representing historical episodes, I presented them to participants for member checking purposes and gained their input for revisions

Researchers and practitioners who engage in investigations using activity systems analysis need to be aware that while this methodology is used to understand real-world complex situations, it cannot represent the complexities in its entirety. In this unavoidable simplification process during the analysis investigators need to be systematic and purposeful about how they summarized participants' experiences. Investigators need to focus on identifying, summarizing, and reporting activities that are essential and relevant to the research questions to provide a trustworthy interpretation of the data set.

I have developed some strategies to represent participant experiences in a trustworthy manner. One method involves going back to the research question while determining what information I ought to include in the data presentation Additionally, I have introduced the data-based activity systems to both primary and secondary participants during member checking sessions and asked them to comment and correct the triangle models to better reflect their experiences. Participants have been very cooperative during these meetings and helped identify how to better portray their activities. Finally, professional conversations with colleagues during conference presentations and feedback from journal reviewers and editors about my work have provided me with insight on how to better represent participant experiences following the triangle model.

As further work continues with new researchers and practitioners choosing to use this methodology, there needs to be more discussion on how to identify contextual data that are pertinent in the analysis and how they can be represented in forms

other than the simple triangle model. These strategies are often not shared or discussed. There needs to be more researchers and practitioners who provide information in their work about the strategies they used for specifically maintaining trustworthiness in their activity systems analysis.

Summary in Relation to Future Design of Activity Systems Analysis Investigations

In Table 3.1 I have summarized the strategies for researchers and practitioners to consider when engaging in activity systems analysis based research and program evaluation. I have suggested these strategies to specifically address the criticisms against activity theory and activity systems analysis introduced in this chapter.

Table 3.1 Design issues to consider in future activity systems analysis investigations

When discussing activity systems analysis as a viable methodology for examining complex real-world human activities:

- Demonstrate fluency in CHAT especially on Vygotsky's mediated action;
- Explain activity systems analysis as a method for pursuing activity theoretical data analyses and explain how it is an operational representation of activity theory; and
- Discuss the added value for engaging in activity systems analysis.

When discussing the methodology:

- Define object-oriented activity as the unit of analysis from an activity theory perspective, and make sure to discuss it as a series of mediated action;
- Describe how object-oriented activities related in the study will be identified as bounded systems based on the research question;
- Do not claim that the results of activity systems analysis are generalizable and emphasize particularization instead;
- Discuss specific strategies implemented for maintaining trustworthiness in relation to the activity systems analysis; and
- Discuss naturalistic/qualitative research strategies used for maintaining trustworthiness.

When collecting data:

- Use data collection strategies that will address both observable behavior and cognitive mental activities; and
- When trying to make any claims that study findings are relevant to other situations use multiple methods both qualitative and quantitative that complement activity systems analysis, and be specific about what aspects of the data analysis can be applied beyond the reported case.

When conducing data analysis and summarizing findings:

- Explain how the analysis and findings impact both the research and participant practice;
- Be honest about how activity systems analysis involves an interpretative process that presents the investigator's rendition of the data;
- Discuss the results from the specific strategies implemented for maintaining trustworthiness and how that benefited the study; and
- Discuss what further strategies could be used for improving future activity theory work.

In the table, I have identified when and how investigators can address the criticisms in the course of their future investigations.

In reflection, I have found that when researchers and practitioners buy into a holistic theoretical paradigm and conduct qualitative research they need to clearly state the holistic paradigm that may be new to the reader and explain the reader how data collection, analysis, and discussion of findings are typically carried out. Qualitative data analysis and presentation from any theoretical perspective involve a distillation process where the data is interpreted from the investigator's perspectives of what she observed. Therefore, data analysis and presentation involves a purposeful and systematic simplification of participant real-world activities. In this process it is the investigator's responsibility to ensure that their interpretation truthfully represents participants' activities through the lens of the theories guiding the study.

Chapter 4
Examples of Activity Systems Analysis Used in Research for Various Purposes

Keywords Activity systems analysis examples • Designing investigations with activity systems analysis

This chapter will provide examples of how scholars have applied activity systems analysis in their work and what new insights their work contributed to the development of activity systems analysis as a viable methodology for investigating complex learning environments. The examples will demonstrate how researchers and practitioners have used activity systems analysis in a variety of contexts for different purposes. The examination of each example will provide ideas on how to use activity systems analysis to design and engage in investigations of human interactions.

For the discussions in this chapter, I identified a set of criteria for selecting appropriate examples. The first criterion was that the example provided new knowledge about how to use activity systems analysis. The second criterion was that the author's understanding of activity theory and activity systems analysis was thorough and accurate. The third criterion was that the author provided a clear description of the data collection and analysis procedures. The fourth criterion was that the author's use of activity systems analysis reflected a thorough and accurate understanding of the theoretical framework and analysis process.

While identifying appropriate examples following my criteria, I found seven studies that fell into four distinct work clusters. These clusters included works that help (a) understand developmental work research (DWR), (b) describe real-world learning situations, (c) design human computer interaction systems, and (d) plan solutions to complicated work-based problems. There is at least one example in each cluster discussion and, when appropriate, I have provided a second example.

I identified nine common elements of research studies to anchor the discussions in this chapter and followed a consistent framework for the introduction of each example. These elements include research purpose, research question, data context, data sources, data analysis techniques, the unit of analysis, use of activity systems analysis, results, and implications. I chose these elements to characterize

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each example because they are aspects of an investigation that researchers and practitioners need to carefully consider when designing and implementing their own studies. All of the elements for each example are summarized in Tables 4.1, 4.2, 4.3, 4.4.

Some authors of the selected examples did not provide a clear reference to the nine research elements. When this happened, to maintain consistency and to provide a coherent discussion, I interpreted the information provided in the example and prepared a description of the missing element. This often occurred when the authors did not provide a clearly stated research question. Thus, I formulated a question

Table 4.1 Activity systems analysis for understanding developmental work research

Engeström, Y. (1993). Developmental studies of work as a testbench of activity theory: The case of primary care medical practice. In S. Chaiklin & J. Lave (Eds.), *Understanding practice: Perspectives on activity and context (pp. 64–103).* New York: Cambridge University Press	
1. Research purpose	To use activity theory as a framework in developmental work research (DWR) and present examples for analyzing how systemic contradictions at a health care system in Finland affect doctor and patient interactions
2. Research question	How can activity theory and activity systems analysis help developmental work research in a hospital setting to identify systemic contradictions that affect the quality of daily interactions between doctors and patients?
3. Data context	Part of a large-scale longitudinal study that took place in two publicly funded hospitals in Espoo, Finland during the mid to late 1980s. The data presented in the book chapter is from a data set that included 16 doctors, 23 support staff such as nurses and administrators, and 85 patients
4. Data sources	Patient doctor consultation videos, individual interviews, and stimulated recall interviews based on consultation videos
5. Data analysis techniques	Discourse analysis
6. Unit of analysis	Individual doctor activity while s/he was working with patients to diagnose their conditions. The description of this activity is based on collective experiences described by multiple participant sources
7. Use of activity systems	Traced how in the history of public health care in Finland there are systemic contradictions that restrict the doctors from providing quality care to patients
8. Results	Provided a concrete example of how activity systems analysis can be used in qualitative research for understanding collective participant experiences and how those experiences are entrenched with systemic contradictions developed over time
9. Implications	Introduced activity theory as a cross-disciplinary methodological tool for designing and implementing research that can be both practical and theoretical

(continued)

Table 4.1 (continued)

Engeström Y. (2000) Activity theory as a framework for analyzing and redesigning work. *Ergonomics, 43*(7), 960–974. doi: 10.1080/001401300409143	
1. Research purpose	To use activity systems analysis as a method to facilitate participant driven interventions for patient care at a children's hospital in Helsinki, Finland
2. Research question	How can activity systems analysis within the context of developmental work research bring together multiple participants and stakeholders at a children's hospital to design and implement interventions for improving patient care?
3. Data context	Part of a large-scale longitudinal multi-organizational study that took place at a children's hospital in Helsinki, Finland during the late 1990s. The first data set presented in the article focuses on a doctor and his interactions with his patient, support staff, and medical specialists. The second data set includes the collective experiences of 60 participants that included doctors, nurses, staff, administrators, and mothers of patients from various health care organizations involved with the children's hospital
4. Data sources	Patient doctor consultation videos, individual interviews, stimulated recall interviews based on consultation videos, and participatory group discussions after viewing video cases for identifying interventions to alleviate tensions in patient care
5. Data analysis techniques	Discourse analysis
6. Unit of analysis	An individual doctor's efforts for providing services to a patient (goal-directed actions) and individual doctor activity for providing care to patients (object-oriented activity) based on collective experiences described by multiple participant sources
7. Use of activity systems	Documented how the activity systems model can be used to analyze both goal-directed actions and object-oriented activities. Used both analyses to identify systemic contradictions that brought tensions to individual doctor and patient interactions and used it as a guide for designing and implementing interventions to medical practices at the children's hospital
8. Results	Provided examples of goal-directed actions and object-oriented activities, and how goal-directed actions can be a part of an object-oriented activity
9. Implications	Introduced how the activity systems model can be used for both describing a series of goal-directed actions and an object-oriented activity; however, the unit of analysis in activity systems analysis is the object-oriented activity that represents a more robust historically evolving activity that may involve communal motives

Table 4.2 Activity systems analysis for describing real-world learning situations

Barab, S. A., Barnett, M., Yamagata-Lynch, L., Squire, K., & Keating, T. (2002). Using Activity Theory to Understand the Systemic Tensions Characterizing a Technology-Rich Introductory Astronomy Course. *Mind, Culture, and Activity*, *9*(2), 76. doi: 10.1207/S15327884MCA0902_02	
1. Research purpose	To use activity theory as a theoretical and analytical framework for describing how undergraduate students learn astronomy concepts while developing models of the solar system with a computer-based 3D virtual tool in a project-based course
2. Research question	How can activity systems analysis be used to describe student group interactions while they are building a 3D virtual model of the solar system in a university introductory astronomy course?
3. Data context	Part of a team-based longitudinal study of an undergraduate introductory astronomy course in Indiana, United States, which took place during the late 1990s to early 2000. The data presented in the article includes videotaped student interactions in class and student interviews. Participants included 33 undergraduate students
4. Data sources	Student group in class interactions on video, student and teacher interviews, field notes, student-created 3D models of the solar system, and other student produced materials
5. Data analysis techniques	Thematic analysis
6. Unit of analysis	Student group interactions as a series of goal-oriented actions that represent a goal-oriented activity and institutional activity based on collective experiences described by multiple participant sources
7. Use of activity systems	Described how groups of students came to understand both scientific and technological concepts from a series of activities that helped them build robust understanding of the course content. Additionally, conducted an analysis of systemic contradictions related to undergraduate introductory astronomy courses
8. Results	Provided concrete examples of how activity systems analysis can be used for following team interactions within a participatory learning environment
9. Implications	The authors demonstrated how the analysis of student level object-directed actions can be influenced by persistent systemic contradictions in the course level object-oriented activity. They also used activity systems analysis as a guide for presenting how student teams confronted tensions and systemic contradictions and gained a robust understanding of content knowledge

Table 4.3 Activity systems analysis for designing human–computer interaction systems

Engeström, Y., & Escalante, V. (1996). Mundane tool or object of affection? The rise and fall of the Postal Buddy. In B. A. Nardi (Ed.), *Context and consciousness: Activity theory and human–computer interaction.* MA: MIT Press	
1. Research purpose	To examine the Postal Buddy Kiosk as a sophisticated technological innovation and analyze the events related to its rising popularity and quick demise
2. Research question	How can activity systems analysis be used to understand the systematic contradictions that affected the rising popularity and the sudden implementation failure of the United States Postal Services' (USPS) Postal Buddy Kiosk?
3. Data context	Historical analysis of events related to the inception and cancellation of the Postal Buddy Kiosk contract with USPS during the late 1980s and early 1990s
4. Data sources	Macro level data included interviews with people involved in the business and technology development of the Postal Buddy Kiosk and document analysis. Micro level data included interviews with developers regarding how they talk about the Postal Buddy and videotapes of customers' interactions with the system
5. Data analysis techniques	Discourse analysis
6. Unit of analysis	Postal Buddy Corporation CEO's experience developing the Postal Buddy Kiosk and working with USPS informed by the shared experiences described by multiple participants
7. Use of activity systems	Synthesized a multi-participant complex human activity involved with the development and implementation of the Postal Buddy Kiosks at USPS
8. Results	Presented how activity systems analysis can be used to describe shared activities involved in the development and implementation of sophisticated technology innovations and how the human interaction side of development and implementation can affect its success or failure
9. Implications	Activity systems analysis can complement other methods such as actor network theory-based analysis to provide further information on how human relationships shared within multi-organizational contexts can contribute to bringing about systemic contradictions and cause tensions in individual participant activities
Mwanza, D. (2002a). Conceptualizing work activity for CAL systems design. *Journal of Computer Assisted Learning, 18*(1), 84–92. doi: 10.1046/j.0266-4909.2001.00214.x	
1. Research purpose	To use the Eight-Step-Model and identify design requirements for a computer system that will support knowledge sharing activities in an organizational setting
2. Research question	How can activity systems analysis using the Eight-Step-Model help describe workplace practices to guide the identification of design requirements for a Computer Assisted Learning (CAL) system?
3. Data context	Two-year ethnographic study at two European-based organizations

(continued)

Table 4.3 (continued)

Mwanza, D. (2002a). Conceptualizing work activity for CAL systems design. *Journal of Computer Assisted Learning, 18*(1), 84–92. doi: 10.1046/j.0266-4909.2001.00214.x	
4. Data sources	Observations of work practices, observations of informal and formal meetings, general interviews, interviews using the Eight-Step-Model, surveys, document analysis of work manuals, and field notes
5. Data analysis techniques	Thematic analysis specifically targeted to identify how the data set fit into the activity systems model using the Eight-Step-Model
6. Unit of analysis	Collective participant workplace experiences described by multiple participant sources
7. Use of activity systems	Described work-related activity at two different organizations to compare how each situation affected the organizations' ability to engage in knowledge sharing activities
8. Results	Identified how activity systems analysis can be a useful tool for CAL systems designers
9. Implications	Demonstrated how activity systems analysis can be used as a framework for engaging in cross-case analyses of complex human workplace practices involved in sharing tacit knowledge

Table 4.4 Activity systems analysis for planning solutions to complicated work-based problems

Marken, J. A. (2006). An application of activity theory: A case of global training. *Performance Improvement Quarterly, 19*(2), 27–50. doi: 10.1111/j.1937-8327.2006.tb00364.x	
1. Research purpose	To use activity systems analysis within Human Performance Technology (HPT) so that practitioners can find practical applications of this method for designing and developing training
2. Research question	How can HPT professionals use activity systems analysis following Mwanza's (2002b) Eight-Step-Model for improving client performance issues by identifying pre-existing systemic contradictions?
3. Data context	Case study with an action research tendency to improve participant practices
4. Data sources	Individual and group interviews using the Eight-Step-Model as a guide for discussions, observations, and field notes
5. Data analysis techniques	Thematic analysis
6. Unit of Analysis	Individual trainer and trainee activity based on collective experiences described by multiple participant sources
7. Use of Activity Systems	Described work-related activity at the multinational organization based on participant roles and made comparisons of how systemic contradictions affected individual work across roles

(continued)

Table 4.4 (continued)

Marken, J. A. (2006). An application of activity theory: A case of global training. *Performance Improvement Quarterly, 19*(2), 27–50. doi: 10.1111/j.1937-8327.2006.tb00364.x	
8. Results	Participants were able to use the Eight-Step-Model and activity systems analysis to proactively identify systemic contradictions, find potential solutions, and help participants to identify them quickly
9. Implications	Activity systems analysis related questions developed by Mwanza (2002b) are very usable with participants in corporate settings facing HPT issues; however, it was difficult to initiate discussions with participants using Engeström's (1987) triangle model
Yamagata-Lynch, L. C., & Smaldino, S. (2007). Using Activity Theory to Evaluate and Improve K-12 School and University Partnerships. *Evaluation and Program Planning, 30*(4), 364–380. doi:10.1016/j.evalprogplan.2007.08.003	
1. Research purpose	To develop an activity theory based method for evaluating, planning, and implementing new K-12 and university partnership activities
2. Research question	How does the new evaluation and planning tool based on activity systems analysis affect partnership meeting outcomes and develop new theoretical understandings?
3. Data context	Part of a 2-year study during 2004–2006 that participants were involved in ongoing K-12 school university partnership meetings and discussions
4. Data sources	Targeted focus group meetings using a modified activity systems model as a data collection tool and follow-up group discussions
5. Data analysis techniques	Thematic analysis following the constant comparative method (Strauss and Corbin 1998)
6. Unit of analysis	Individual activity of partnership participants based on collective experiences described by multiple participants
7. Use of activity systems	Demonstrated how to use activity systems model as a data collection tool as well as an analysis tool for understanding complex human interactions in K-12 school and university partnerships
8. Results	Presented how activity systems analysis can alleviate communication difficulties between schools and universities in their partnership efforts due to cultural differences among multi-organizational boundaries of each partnership participants. The focus group discussions centered on using the modified activity systems model to describe participant situation helped them identify sources of tensions in their partnership activity and potential solutions
9. Implications	Activity systems analysis can be used as an analytical tool by research participants for facilitating communication and help understand the complexities involved in K-12 school and university partnerships

specifically from an activity theory perspective after considering the information the author provided.

In general, the seven studies were extensive qualitative investigations that often involved multi-year data collection. All studies were a form of naturalistic inquiry data collection methods (Lincoln and Guba 1985), which involved triangulated data collection through interviews, persistent engagement in the field, observations, document analysis, and artifact analyses. All studies had distinct research questions that influenced the unit of analysis that the authors examined. Some authors explicitly stated that they conducted member checking with selected participants to collect further information. Furthermore, many of the authors worked in teams, which enhanced trustworthiness of their work through researcher triangulation (Denzin 1989). For data analysis, authors conducted discourse analysis or thematic analysis and some authors specifically stated that they followed Strauss and Corbin's (1998) constant comparative method.

Activity Systems Analysis for Understanding Developmental Work Research

Developmental work research (DWR) makes use of activity theory to recognize areas to implement organizational change by identifying systemic contradictions that bring tensions to participant activities (Engeström 1993). According to Engeström, activity theory is a framework that compliments DWR and can serve as a theoretical and practical cross-disciplinary methodological tool for informing the organizational change process. In DWR, the research team often engages in longitudinal and extensive investigations involving interviews, observations, and document analysis with a large number of participants. The research team often takes an active role in the organizational change processes while collaborating with participants to identify systemic contradictions and possible solutions to alleviate tensions in everyday work activities.

The two examples I introduce in this cluster are Engeström (1993) and Engeström (2000). Both studies took place within a medical setting and examined how interactions among activities of multiple individuals at the workplace affected the participants' ability to meet both their individual and organizational objects. The implications of these works will be relevant to researchers and practitioners who are interested in using DWR to examine human interactions and their impact to the organizational dynamics both in workplace settings and in educational settings.

Example 1

Engeström (1993) introduced DWR and activity systems analysis to the North American audience as a chapter in an edited book about understanding human activity within the context of everyday practice. While this chapter did not present

a case involving an entire DWR cycle, it described what DWR is and how it can be designed and implemented when researchers and participants collaborate in investigations. After its publication, this chapter became one of the well-cited primary sources on activity systems analysis along with Engeström (1987), Cole and Engeström (1993), and Engeström (1999a).

The purpose of Engeström (1993) was to use activity theory as a DWR framework and present examples for analyzing how systemic contradictions at a health care facility in Finland affect doctor and patient interactions. In this book chapter, Engeström provided an introduction to DWR, an introduction to activity theory, and the results from using activity systems analysis to supplement a qualitative investigation. Engeström did not provide a research question in this work; however, a well-suited question from a CHAT perspective is: How can activity theory and activity systems analysis help developmental work research in a hospital setting identify systemic contradictions that affect the quality of daily interactions between doctors and patients?

Engeström presented this study as part of a large-scale longitudinal investigation that took place between the mid to late 1980s in Espoo, Finland. The participants included 16 doctors, 23 support staff such as nurses and administrators, and 85 patients. With these participants, the research team engaged in individual interviews, observed patient doctor consultations, and conducted stimulated recall interviews based on the consultation videos. After the data collection, the research team conducted a discourse analysis of these extensive qualitative data sets.

The unit of analysis in this investigation was the activities that individual doctors engaged in while s/he worked with patients to diagnose their conditions. This individual activity was drawn from the shared experiences reported by multiple participants including doctors, patients, support staff, nurses, and administrators. Much like a well-triangulated qualitative study, even though the unit of analysis was individual doctor activity, a diverse group of participants contributed to the portrayal of a trustworthy account of this activity.

Figure 4.1, which is an adaptation from Engeström (1993, p. 88), represents the results of the activity systems analysis. The figure illustrates a typical activity that doctors encounter when urgent care patients come to the hospital with ambiguous conditions that could be either biomedical or psychological problems. The subject in this activity is the individual doctor and the object is the doctor's attempt to provide the best care to a high number of patients who come to the urgent care facility. Additionally, the figure includes information on the systemic contradictions and tensions that individual doctors have to maneuver while diagnosing their patients' conditions.

While the reader will need to examine Engeström's original text to fully appreciate how the qualitative data is represented in Fig. 4.1, examining the figure alone can provide insights to how the results of an activity systems analysis can capture complex human interactions and the implications of the analysis. Each component in this figure represents an observation that Engeström made of the prevalent systemic contradictions at the hospital. For example, the subject component indicates that when a doctor is trying to provide care to urgent care patients s/he needs

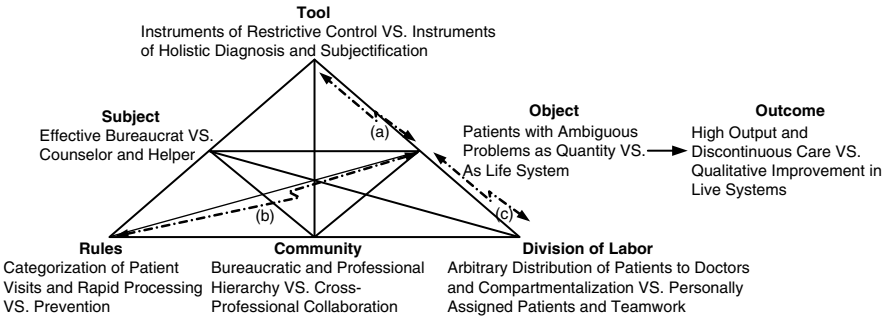


Fig. 4.1 Systemic contradictions that doctors encountered in Engeström (1993). Reprinted with permission of Cambridge University Press. Engeström, Y. (1993). Developmental studies of work as a testbench of activity theory: The case of primary care medical practice. In S. Chaiklin & J. Lave (Eds.), *Understanding practice: Perspectives on activity and context* (pp. 64–103). New York: Cambridge University Press

to juggle his/her role as an effective bureaucrat within the health care system to being a counselor and a helper to the patient.

A high number of patients in Finland choose to visit the urgent care facility rather than make appointments for regular visits with their doctor because it takes weeks to secure an appointment. Urgent care appointments are easier to obtain in a timely manner, but the doctors are under enormous pressure to diagnose patient cases quickly and move on to the next patient. In these situations, doctors often feel that they cannot spend the time they need to make accurate diagnoses of patient conditions. This systemic contradiction is represented in the rule component as "categorization of patient visits and rapid processing vs prevention." This contradiction introduces a tension into the individual doctor's activity that is represented as a diagonal line in the figure and labeled as "(b)" between the rule and object. Doctors who participated in Engeström's study who worked in urgent care facilities found themselves in difficult situations because they were fighting against the hospital rule for rapidly processing patient cases while trying to meet their self-imposed rule of providing best services to patients.

As a result of this work, Engeström (1993) introduced DWR as an investigative method that is complementary to activity theory approaches. He also demonstrated how activity systems analysis can be used as a cross-disciplinary methodological tool to investigate systemic contradictions in everyday work environments to uncover both theoretical and practical findings. However, in this work Engeström did not demonstrate how activity systems analysis can be used as a practical tool for assisting the DWR process.

Example 2

Engeström (2000) provided another account of DWR at a children's hospital in Helsinki, Finland. In this work, he further described the DWR process and the

role activity systems analysis took in the theoretical and practical aspects of an investigation. The purpose of this work was to use activity systems analysis as a method to facilitate participant driven interventions for patient care at the children's hospital. A well-suited research question based on this purpose is: How can activity systems analysis within the context of developmental work research bring together multiple participants and stakeholders at a children's hospital to design and implement interventions for improving patient care?

Engeström presented this study as part of another large-scale longitudinal multi-organizational investigation in the late 1990s. The data set include two types of data. The first type focused on the activity of individual doctor and how they interacted with patients, support staff, and medical specialists when providing care to patients. The second type of data was the collective experience of 60 study participants including doctors, nurses, staff, administrators, and mothers of patients from various healthcare organizations involved with the children's hospital operations. The data collection methods included observations of doctor patient consultations, interviews, stimulated recall interviews of the patient–doctor consultation videotapes, and participatory group discussions designed to generate patient care interventions. The research team conducted a discourse analysis of the exhaustive qualitative data set.

The unit of analysis in this work included both individual doctor goal-directed actions and individual doctor object-oriented activity. The series of goal-directed actions documented the tasks that a doctor encounters while diagnosing patient conditions. These actions were identified as a result of extensive observations of doctor workplace activities. A doctor's object-oriented activity was identified through further investigations with various participant groups. Thus, a doctor's object-oriented activity was constructed from the shared experiences that participants shared with the investigators.

Engeström (2000) describes the turn-taking, goal-directed actions between doctors and specialists as they diagnose a patient's case and decide on a course of treatment. In the triangle models representing these actions, the object component may include people or artifacts that need temporary attention and not necessarily a goal, motive, or reason for participating in an activity, which may be the case when describing object-oriented activity. For example, Fig. 4.2 is an adaptation from one of the activity systems triangles in Engeström (2000, p. 962). In this goal-directed action, the object of attention is patient records and test results. The doctor is paying attention to these two artifacts while interpreting the patient's case file. The rules, community, and division of labor components were deliberately left blank because the doctor did not identify a role in these three components while executing the task.

In later sections of the article, Engeström (2000, p. 965) introduced another activity system that represented the tensions that doctors encounter while patients are moving between their primary care facility and the hospital. Figure 4.3 is an adaptation of this activity in which the subject is the doctor who is working with patients who are bounced between the primary care facility and the hospital. The diagonal lines with arrows in the figure indicate the components in the system that are in conflict with one another and bringing tensions to the activity. For example

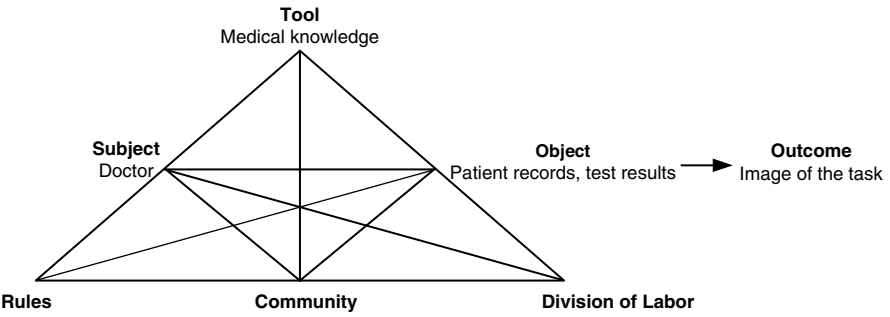


Fig. 4.2 Doctor's goal-directed action while interpreting patient file in Engeström (2000). Reprinted with permission of Taylor & Francis Engeström, Y. (2000). Activity theory as a framework for analyzing and redesigning work. *Ergonomics*, *43*(7), 960–974. doi: 10.1080/001401300409143

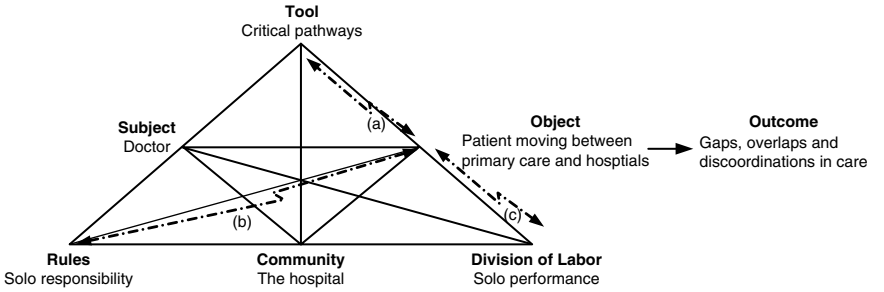


Fig. 4.3 Individual doctor patient care activity in Engeström (2000). Reprinted with permission of Taylor & Francis. Engeström, Y. (2000). Activity theory as a framework for analyzing and redesigning work. *Ergonomics*, *43*(7), 960–974. doi: 10.1080/001401300409143

in tension (b) and (c), the predominant culture in the medical field that maintains that doctors should work individually rather than collaboratively acts as an obstacle for doctors to provide patients with the best care possible. In this situation, doctors often found it difficult to collaborate with specialists due to unnecessary redundancies and lack of coordination.

As a result of this work, Engeström (2000) documented how activity systems analysis can be used to examine both goal-directed actions and object-oriented activities. This is a unique contribution because few authors describe the differences between goal-directed actions and object-oriented activity with concrete examples within the context of activity systems analysis. Engeström emphasizes that activity theorists are interested in examining object-oriented activities and they conduct analysis of goal-directed actions to gain further understanding of the activity. He describes goal-directed actions as temporary and object-oriented activities that are historically evolving and that are part of a network of other object-oriented activities.

Engeström examined both goal-directed actions and object-oriented activities to analyze and identify systemic contradictions that brought tensions to individual doctor and patient interactions. He used this information as a guide to collaborate with participants to design and implement change in medical practices.

Describing Real-World Learning Situations with Activity Systems Analysis

Understanding and describing human activity in real-world situations often involves complicated data collection, analysis, and presentation methods. Authors who are interested in such endeavors often choose qualitative research methodologies and have relied on activity systems analysis as one method for making credible systemic inferences and drawing coherent theoretical implications (Yamagata-Lynch 2007). In these works, the use of activity systems analysis as a data analysis and presentation tool can help readers understand the complexities involved in real-world situations to find meaningful information while avoiding becoming overwhelmed by the data.

In Example 3, I will introduce Barab, Barnet, Yamagata-Lynch, Squire, and Keating (2002). This study took place within a nontraditional undergraduate course that required students to participate in project-based inquiry. The data collection and analysis focused on student actions, course structure, and student learning. The implications from this study will be relevant to researchers and practitioners who are interested in unconventional learning environments in both K-12 and higher education settings.

Example 3

The purpose of Barab et al. (2002) was to use activity theory as a theoretical and analytical framework to describe how undergraduate students in a project-based course learn astronomy concepts by developing models of the solar system with a computer-based 3D virtual tool. During a university semester, the researchers used activity systems analysis to capture and describe how students relied on conceptual tools, technological tools, experiences with peers while learning new astronomical concepts and building 3D models of the solar system. The research question that best fits this work is: How can activity systems analysis be used to describe interactions of a student group building a 3D virtual model of the solar system in a university introductory astronomy course?

Barab et al. (2002) conducted this study as part of a team-based longitudinal investigation. This work took place in Indiana, United States during the late 1990s to early 2000 and included 33 undergraduate students as participants. The research team followed the naturalistic inquiry methods (Lincoln and Guba 1985) for data

collection that included observations, field notes, video captures of individual group activities, interviews with students and instructors, document and artifact analyses, and retrospective recall analysis. The research team engaged in a thematic analysis of the large data set while using activity systems as a guide for identifying the salient themes. When the themes were identified and activity systems were drawn, the team examined systemic contradictions and tensions in the data set. At the conclusion of this analysis, the team conducted member checking with former students and instructors to refine the results.

Much like Engeström (2000), Barab et al. (2002) identified two levels of units of analyses. The first unit was a series of goal-directed actions in which small groups of students engaged while learning astronomical concepts and developing 3D virtual models of the solar system. The second unit was the course level object-oriented activity that was constructed by analyzing collective experiences of students and instructors. Both the student team goal-directed actions and the course level object-oriented activities were drawn from the same data set; first the student team goal-directed actions were identified, then these actions became a data source for identifying the course level object-oriented activity.

For example, Fig. 4.4 is an adaptation from Barab et al. (2002, p. 98) and is one of the many activity systems that represent a student team goal-directed action. In this example, Barab et al. introduce a set of actions related to a student team of one male and one female. After completing their first 3D virtual model of the Celestial Sphere, this team realized that the quality of their model suffered because they did not communicate and establish a plan for their shared responsibilities during the development process.

The series of actions in Fig. 4.4 represents the beginning of the second team project which was to develop a model of the Earth–Moon–Sun system. In Action A, the team members struggled to decide which tasks needed to be completed for the project and how to divide and coordinate those tasks between the two members. In the first action, the subject is Kurt, a male team member. He created a table of planetary scales, the object of the action. His textbook and math skills were the tools he used to create the table. The context of this action included the rules for following the project plan, the community that was reflected in the classroom microculture, and the distribution of labor that was reflected in their group dynamics. In Action B, Kurt and Mandy worked together using the planetary scale from Action A to divide the tasks and create a work plan for the second project. The subject in Action B is both Kurt and Mandy as team members, the tool was the planetary scale from Action A, and the object was the division of tasks. Both Action A and B contributed to the outcome in which Kurt and Mandy generated a work plan.

Barab et al. showed the relationship between Actions A and B by drawing a smaller version of Action A and connecting its object into the tool for Action B with a curved arrow. The authors refer to this type of relationship between activity systems as a nested system when a component of one activity system is subsumed into another component of a new activity. This idea of nested systems is very useful when analyzing complicated human activity over time because it can capture how a previous or simultaneous activity can affect another activity.

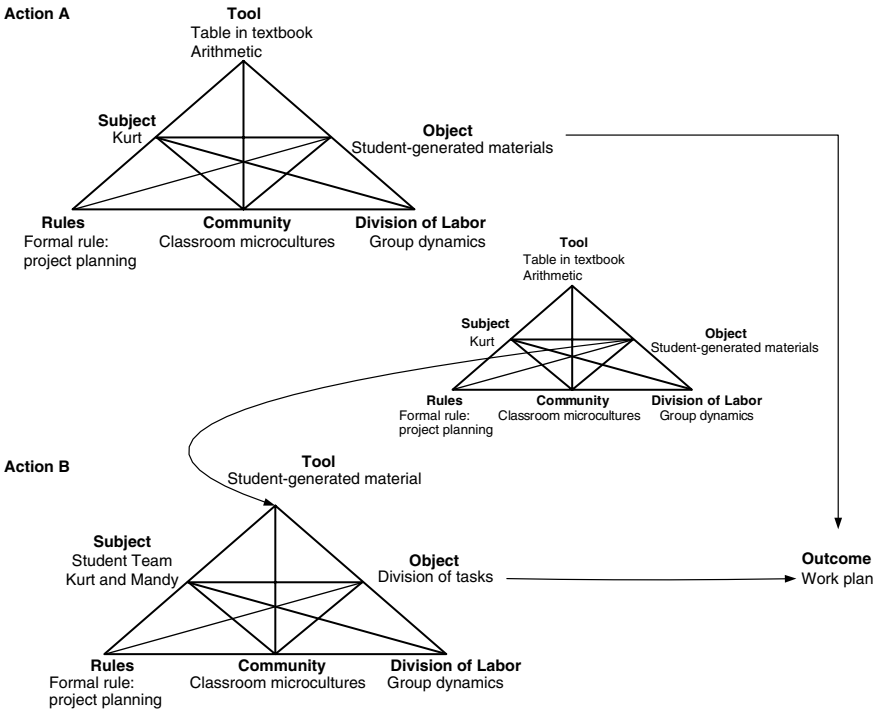


Fig. 4.4 Student team goal-directed action in Barab et al. (2002). Reprinted with permission of Taylor & Francis. Barab, S. A., Barnett, M., Yamagata-Lynch, L., Squire, K., & Keating, T. (2002). Using Activity Theory to Understand the Systemic Tensions Characterizing a Technology-Rich Introductory Astronomy Course. *Mind, Culture, and Activity*, *9*(2), 76. doi: 10.1207/S15327884MCA0902_02

While presenting the course level object-oriented activity Barab et al. (2002) demonstrated how each action they examined was an example of systemic contradictions that participants found in the astronomy course. The course level object-oriented activity that Barab et al. presented in their article was similar to Fig. 4.1 in this chapter, which was an adaptation from Engeström (1993). Thus the presentation of the course level activity highlighted the systemic contradictions and how they brought tensions to daily student course-related actions.

The contribution that is unique to Barab et al. (2002) is that the authors provided a clear connection between the course level activity and student team actions. For example, the actions in Fig. 4.4 were presented as an instance of how one of the systemic contradictions in the course activity brought difficulties to students while they were managing emergent group project expectations and securing the distributed division of labor among team members. Therefore, presenting both the course level object-oriented activity and the student team level goal-directed actions helps readers understand how systemic contradictions affect participant engagement in the course.

As a result of this work, Barab et al. (2002) provided concrete examples of how activity systems analysis can be used to follow team interactions within a participatory learning setting. The authors demonstrated how the analysis of student level goal-directed actions can be influenced by persistent systemic contradictions in the course level object-oriented activity. They also used activity systems analysis as a guide for presenting how student teams confronted tensions in the course and gained a robust understanding of content knowledge.

Activity Systems Analysis for Designing Human Computer Interaction Systems

Since the publication of Nardi (1996) there has been an increasing interest in the Human Computer Interaction (HCI) field for using activity systems analysis to identify socio-technical issues surrounding HCI systems. Traditionally, the field of HCI has relied heavily on cognitive models for understanding human behavior and knowledge formation processes. However, as articulated in works such as Suchman (1987) traditional HCI approaches can limit software and hardware designers with the result that they design and develop products that do not take into account the users' sociocultural context. When a computer system does not fit into the users' sociocultural context, it is difficult for it to become a robust and sustainable product.

The two examples I selected for this cluster are Engeström and Escalante (1996), which is a chapter from Nardi (1996), and Mwanza (2002). Engeström and Escalante explain that by taking an activity theory approach, HCI researchers and practitioners can move away from limiting their work to machines and instead examine machines in the context of social structures that often affect design, development, implementation, and outcomes. Mwanza's work describes how HCI designers can use activity systems analysis as a preliminary analysis tool to understand existing work practices at organizations and use this knowledge to design an optimal HCI system.

Example 4

The purpose of Engeström and Escalante (1996) was to examine the Postal Buddy Kiosk as a sophisticated technological innovation and analyze the events related to its initial rising popularity and quick demise. Postal Buddy Kiosks, an innovation adopted by the United States Postal Service (USPS), was designed to help customers update their home addresses and purchase business cards, address labels, and stamps. The authors engaged in an extensive qualitative study and used both actor network theory analysis and activity systems analysis. The research question that best fit this work is: How can activity systems analysis be used to understand the systematic contradictions that affected the rising popularity and quick implementation failure of the Postal Buddy Kiosk in the United States Postal Services?

Engeström and Escalante (1996) became interested in this project in 1993 when the Postal Buddy Kiosks were installed in post offices in the San Diego area and were being used by customers. When they began their research they were unaware that USPS was going to cancel the contract with Postal Buddy Corporation prematurely in 1994. Engeström and Escalante used activity systems analysis to capture how the Postal Buddy Corporation struggled to develop the Postal Buddy Kiosks as a lovable machine or a human substitute while meeting USPS contract terms. Interestingly, the authors also report on how the Postal Buddy was referred to by developers as a lovable system, while USPS customers as end users referred to it as a source of frustration because it would not function the way they expected.

Engeström and Escalante (2002) conducted this study as a historical analysis of events related to the inception and cancellation of the Postal Buddy Kiosk and the agreement between USPS and the Postal Buddy Corporation during the late 1980s and early 1990s. The authors collected macro level organizational data by interviewing people involved in the business and technology development of the Postal Buddy system and by document analysis. They reported that they had collected limited data from USPS, but they were able to collect rich data from the Postal Buddy Corporation CEO and developers. Micro level data collection involved observations of end-user interactions with the Postal Buddy and interviews with developers. In the data presentation the authors' provide a portion of the raw data including direct quotes from interviews, excerpts from documents, and transcripts of video captures with accompanying still pictures of USPS customers' interactions with the Postal Buddy. The authors conducted a discourse analysis of this extensive qualitative data set. The unit of analysis identified in this study is the Postal Buddy Corporation CEO's experience developing the Postal Buddy and working with USPS.

In Fig. 4.5, which is an adaptation from Engeström and Escalante (1996, p. 366), the Postal Buddy Corporation CEO is the subject and the object is developing the Postal Buddy Kiosk as a lovable machine. According to the authors, the Postal Buddy Corporation CEO and developers devoted their time to developing a lovable machine and they poured a lot of effort into creating programming code to make that happen. This was not necessarily part of the terms of the contract with USPS. USPS was simply looking for functional, reliable, efficient, and cost-saving machines.

From the CEO's perspective, the object in this activity was to develop a lovable machine that can act as a human substitute. The USPS personnel involved in this project may not have seen this as an appropriate object. The tool was the concept of a lovable machine that the developers designed. The rules of this activity were the terms of the contract with USPS and the trust between the corporation and USPS. The community was Postal Buddy supporters, which had only a few members including the developers. The division of labor was the CEO's conceptualizations and strategies for navigating this project. The outcome of this activity was not articulated, but the appropriate outcomes that can be inferred from reading the chapter include miscommunications between the corporation and USPS and the termination of the contract. The tension between the rule component and the object of the Postal Buddy Kiosks as a lovable machine made it difficult for the result of this activity to be perceived as a success by either the corporation or the USPS.

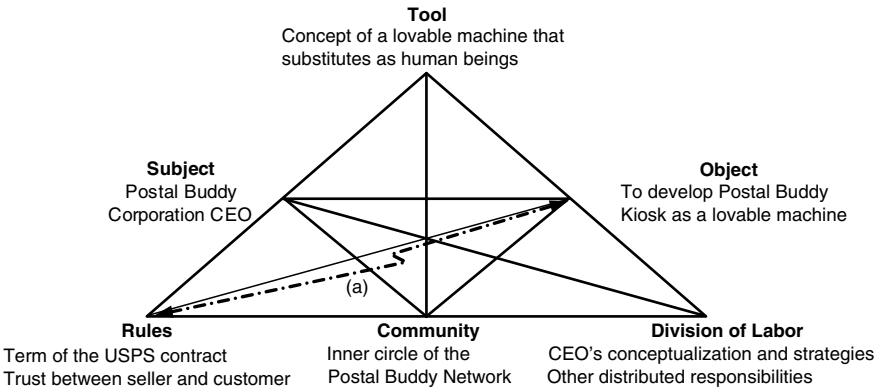


Fig. 4.5 Postal buddy kiosk development activity in Engeström and Escalante (1996). Reprinted with permission of MIT Press. Engeström, Y., & Escalante, V. (1996). Mundane tool or object of affection? The rise and fall of the postal buddy. In B. A. Nardi (Ed.), *Context and consciousness: Activity theory and human–computer interaction*. MA: MIT Press

As a result of this work, the authors presented how activity systems analysis can be used to describe shared activities involved in the development and implementation of sophisticated technology innovations and how the human interaction with a technology-based product can affect its implementation. The authors presented only one activity system, as represented in Fig. 4.5, because that was the area where they had the richest data set. However, if the appropriate data were collected, they could have presented an analysis of similar activities with USPS contract decision makers as the subject of one activity and the USPS customers or end users of the kiosks as the subject in another activity. This would enlighten the reader on how different groups of users and developers of computer systems view the product differently.

The authors presented how activity systems analysis can compliment other analysis frameworks such as actor network analysis. They used actor network analysis to zoom out of the individual activity unit of analysis to identify how human and organizational relations affected the CEO activity. The actor network analysis showed how the corporation, end users, USPS, and local post office personnel relationships were intertwined with one another surrounding Postal Buddy Kiosk implementation. After examining the activity systems analysis and the actor network analysis, the authors identified that the mismatch in what all subjects/actors envisioned as the object of their activities involving the Postal Buddy Kiosks inevitably resulted in its implementation failure.

Example 5

The purpose of Mwanza (2002a) was to use the Eight-Step-Model and identify design requirements for a computer system that will support knowledge sharing activities in an organizational setting. The Eight-Step-Model consisted of a series

of open-ended questions that Mwanza (2002b) developed to help HCI researchers translate their data into activity systems components in the triangle model. Each question she developed was matched to a component in the activity system and was designed to help researchers analyze their data specifically from an activity theory framework. This is a unique contribution to the development of activity systems analysis because it provides a guide for how researchers and practitioners can begin their analyses using this methodology.

The questions Mwanza (2002b) identified in her Eight-Step-Model are presented in Table 4.5. Mwanza (2002a) used the Eight-Step-Model to analyze work practices in two organizations from an activity theory perspective to identify design requirements for a Computer Assisted Learning (CAL) system for those organizations. The appropriate research question for this study is: How can activity systems analysis using the Eight-Step-Model help explain workplace practices to guide the identification of design requirements for a CAL system?

Mwanza (2002a) conducted her study as a 2-year ethnographic study in European-based organizations. The data collection involved observations of work practices, observations of informal and formal meetings, general interviews, interviews using the Eight-Step-Model, surveys, document analysis of work manuals, and field notes. Mwanza's thematic analysis specifically identified how the qualitative data set fit into the activity systems model by using the Eight-Step-Model as a guide. The unit of analysis in Mwanza (2002a) was the collective work-based experiences that were described by multiple participant sources.

Mwanza (2002a) investigated the work practices of organizations and provided descriptive narratives with accompanying activity systems for the analysis and comparison of varying work practices. Figure 4.6 is an adaptation of one of the activity systems introduced in Mwanza (2002a, p. 88). This organization developed and maintained industrial computing systems for customers located all over the world and was working to provide better customer support by encouraging

Table 4.5 Eight-step-model for translating activity systems from Mwanza (2002b)

Identify the…		Question to ask
Step 1	Activity	What sort of activity am I interested in?
Step 2	Objective	Why is this activity taking place?
Step 3	Subjects	Who is involved in carrying out this activity?
Step 4	Tools	By what means are the subjects carrying out this activity?
Step 5	Rules and regulations	Are there any cultural norms, rules, and regulating governing the performance of the activity?
Step 6	Division of labor	Who is responsible for what when carrying out this activity and how are the roles organized?
Step 7	Community	What is the environment in which the activity is carried out?
Step 8	Outcome	What is the desired outcome from this activity?

Note that Mwanza prefers to use the word "objective" in place of "object"

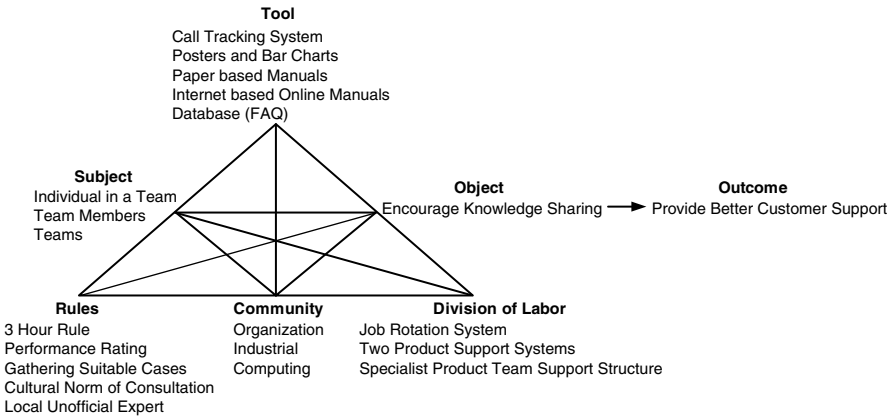


Fig. 4.6 Organizational knowledge sharing activity adapted from Mwanza (2002a). Reprinted with permission of Wiley-Blackwell. Mwanza, D. (2002a). Conceptualising work activity for CAL systems design. *Journal of Computer Assisted Learning*, *18*(1), 84–92. doi: 10.1046/j.0266-4909.2001.00214.x

employees to engage in better knowledge-sharing activities. She used the activity system model to map how existing work related practices fit into each component including the subject, tool, object, rule, community, and division of labor.

For example, in Fig. 4.6 when a member of the organization engaged in knowledge-sharing activities to meet the desired outcome of providing better customer support, s/he had access to resources listed in the tool component such as paper based manuals and databases to meet that object(ive). The organization had a complex set of formal and informal rules that affected the subjects' ability to share knowledge with one another. After identifying this activity and mapping it onto the activity system model, Mwanza (2002a) reported that this company had an informal method for encouraging knowledge sharing among employees that were not tied to any formal rules or existing tools in the system. This informal knowledge-sharing practice was initiated when employees found themselves in project-related crisis situations where they would consult with local community members who had expertise in the situation. Mwanza chose not to identify tensions in the figure, but discussed them in her narrative. One of these tensions was that the existing employee performance assessment system acting as a tool in the knowledge sharing activity did not encourage employees to share knowledge.

As a result of this work, Mwanza (2002a) described how activity systems analysis can be a useful tool for CAL systems designers. CAL systems designers need to be aware of existing workplace practices and sociocultural context and identify systemic contradictions and tensions within activity settings they are examining so that the systems they build address the tensions. She also demonstrated how activity systems analysis can be used as a framework to engage in cross-case analyses of complex human interactions to identify tacit knowledge-sharing practices.

Activity Systems Analysis for Planning Solutions to Complicated Work-Based Practices

There has been a gradual increase in the number of authors choosing to use activity systems analysis for both practical and theoretical research. I have been hesitant to identify their works as examples that fit the DWR cluster because the authors do not make this claim. Instead, they have developed their own unique method for using activity systems analysis as a data collection and analysis tool. These works often involve applying the activity systems model either conceptually or conceptually and graphically to obtain participants' thoughts about their workplace situations.

In the following cluster I will introduce Marken (2006) and Yamagata-Lynch and Smaldino (2007). Marken's study took place in a corporate setting and Yamagata-Lynch and Smaldino's study took place in a higher education setting. Both studies used activity systems analysis as a tool for participants to evaluate their practice and identify how they can introduce change to their work habits to better meet organizational goals. The implications from these examples will be relevant to researchers and practitioners who are interested in using activity systems analysis as an analytical and practical tool to identify how to go about change in workplace practice.

Example 6

The purpose for Marken (2006) was to help Human Performance Technology (HPT) practitioners find practical applications of activity systems analysis in their work to design and develop training programs. He used an activity theory framework and Mwanza's (2002b) Eight-Step-Model to engage in a descriptive case study about how the marketing and training department of a large multinational corporation developed a training retreat for senior sales managers at an affiliate organization in Japan. The research question for this study was: How can HPT professionals use activity systems analysis following Mwanza's Eight-Step-Model to improve client performance issues by identifying preexisting systemic contradictions?

Marken (2006) conducted this study with an action research approach during the course of a 3-month training development project. Marken's initial role within the organization was to serve as an analyst and a designer, but toward the end of the project he became a trainer and delivered the training himself in Japan. He engaged in individual and group interviews using the Eight-Step-Model as a guide for discussion. He took another set of questions from Mwanza (2002b) and used it to guide discussions with participants. These questions are presented in Table 4.6. Marken reported that the questions in Table 4.6 provided him with data that better described complex human interactions than the questions in Table 4.5. The unit of analysis in this research was activities of individual trainers and trainees at the multinational company. Marken collected data about individual activity from

Table 4.6 Questions Marken used in his study based on Mwanza (2002b)

1. What *tools* do the *subject* use to achieve their *objective* and how?
2. What *rules* affect the way the subjects achieve their *objective* and how?
3. How does the *division of labor* influence the way the *subjects* satisfy their *objective*?
4. How does the *tools* in use affect the way the *community* achieves the *objective*?
5. What *rules* affect the way the *community* satisfies their *objective* and how?
6. How does the *division of labor* affect the way the *community* achieves the *objective*?

multiple sources. In addition to interviews, he engaged in observations and took field notes. The data analysis relied on a thematic analysis.

In the data presentation, Marken (2006) describes the global multinational company based on Mwanza's (2002b) questions in Table 4.5. The article provides a detailed narrative about the observed activities that illustrated how work took place in the organization. Then Marken describes the systemic contradictions that existed, especially between the United States headquarters and the affiliate in Japan, to identify the training issues that needed to be addressed in the training development process.

While Marken had all intentions to use the triangle model to engage his participants in further activity systems analysis of their situation, he was unable to find an opportunity to do so in the 3-month period of the project. Thus, instead he used the triangle model himself to better understand the situation. As shown in Fig. 4.7 (Marken 2006, p. 45), Marken deliberately chose to modify the model to keep it simple and highlight the specific components where tensions existed.

Marken's work is interesting because in Fig. 4.7 he put the activity of the trainees in Japan and training developers in the United States side-by-side to show how the U.S. training department team had to accommodate to the training-related tensions that Japanese sales employees experienced. For example, the Japanese employees in the sales department were charged to increase sales. This was a rule within the sales-related activity where the object was to increase sales. However, when a sales representative followed a formal corporate rule to attend mandatory training during work hours, they were unable to engage in activities related to increasing sales due to the time away from the field. This introduced a tension in the Japanese sales representatives' training activity. Thus, Marken suggested that the U.S. training division team develop a program that was relevant and had the potential to enrich the Japanese sales employees' work.

As a result of this work, Marken (2006) demonstrated how study participants can use the Eight-Step-Model to proactively identify systemic contradictions and find potential solutions to tensions they may encounter in future activities. He also found that Mwanza's (2001b) Eight-Step-Model can be used as a communication tool to identify HPT issues with participants in corporate settings. However, he found that it was difficult to initiate discussions with participants about their workplace using Engeström's (1987) triangle model.

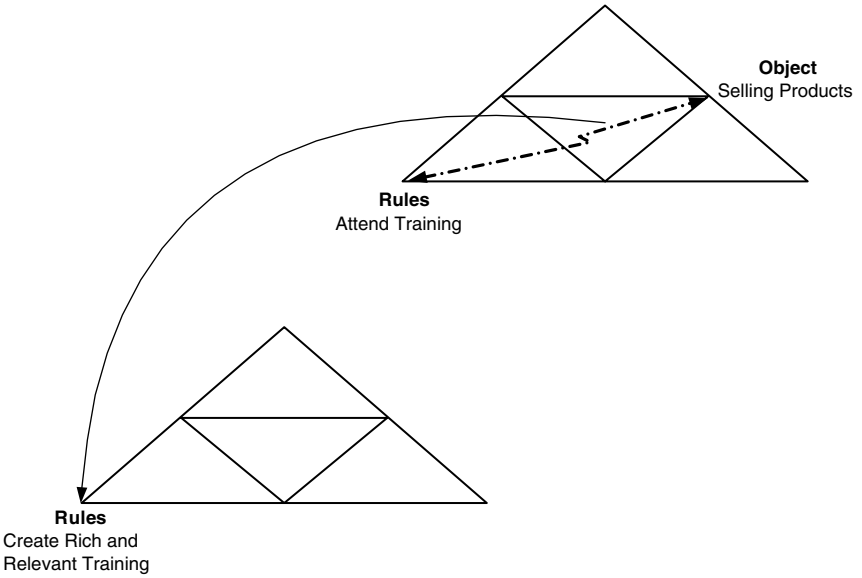


Fig. 4.7 Organizational systemic contradictions from Marken (2006). Reprinted with permission of John Wiley & Sons, Inc. Marken, J. A. (2006). An application of activity theory: A case of global training. *Performance Improvement Quarterly*, *19*(2), 27–50. doi: 10.1111/j.1937-8327.2006.tb00364.x

Example 7

The purpose of Yamagata-Lynch and Smaldino (2007) was to develop an activity theory based method for evaluating, planning, and implementing new K-12 school and university partnership activities. K-12 school and university partnership participants often find that it is difficult to maintain productive communications because of institutional differences that result in systemic contradictions that can affect their collaborative activities. In this study, the authors modified the activity systems model to create an evaluation tool that would identify recurring partnership systemic contradictions and the tensions they bring to partnership participant activities. The investigators and participants worked together to develop strategies for overcoming tensions.

The authors modified the activity systems model to create a communication tool that represented the theoretical constructs in activity theory in a manner that participants can use to help their group discussions. After these group discussions, the authors analyzed the conversations that took place and shared the findings with participants to identify specific strategies for minimizing existing tensions and attain the object of partnership activities. The research question for this study was: How does the new evaluation and planning tool based on activity systems analysis affect partnership meeting outcomes and develop new theoretical understandings?

Yamagata-Lynch and Smaldino (2007) engaged in this research from a practical theoretical perspective in which one of the main goals of the study was to

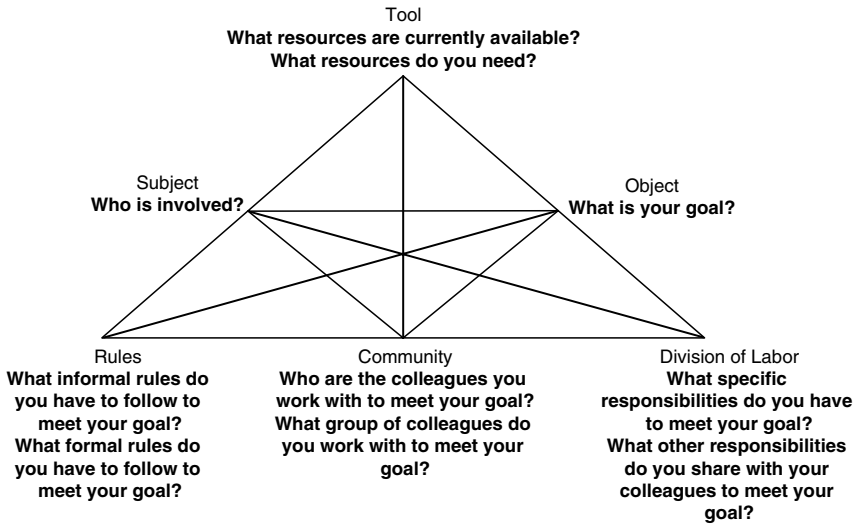
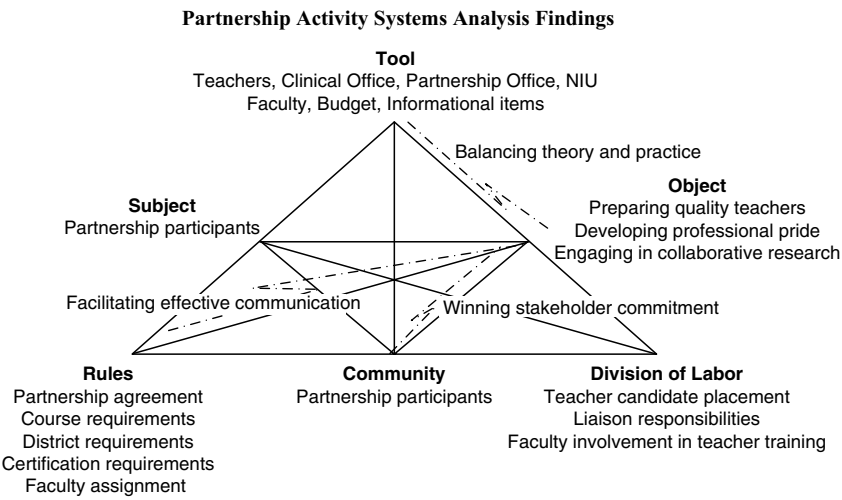


Fig. 4.8 Modified activity system from Yamagata-Lynch and Smaldino (2007). Reprinted with permission of Elsevier. Yamagata-Lynch, L. C., & Smaldino, S. (2007). Using Activity Theory to Evaluate and Improve K-12 School and University Partnerships. *Evaluation and Program Planning*, *30*(4), 364–380. doi:10.1016/j.evalprogplan.2007.08.003

investigate how research can be applied to improve practice. They engaged in this study over a 2-year period from 2004 to 2006. Initial data collection took place in 2004 when the investigators and the participants engaged in three targeted 45-min focus group discussions regarding the overall partnership goals, the K-12 school partnership expectations, and the university partnership expectations. In these discussions, the researchers and participants used Fig. 4.8 (Yamagata-Lynch & Smaldino 2007, p. 369) as a guide for facilitating their dialogue. The modifications to the activity systems model represented in Fig. 4.8 include prompting questions for each element of the model to help participants bring focus in their discussions. These questions were designed to help participants identify observations regarding their partnership activities specifically from an activity theory perspective.

Yamagata-Lynch and Smaldino (2007) initially conducted a thematic analysis of the discussion transcripts following the constant comparative method (Strauss and Corbin 1998). After this analysis, they generated the initial results and prepared a one-page report of the finding to share with participants as shown in Fig. 4.9 (Yamagata-Lynch & Smaldino (2007), p. 374). There were several instances when the authors used this figure during monthly partnership meetings for participants to reflect on their past discussions and develop strategies that could change their work practice to overcome tensions in their activities. In the initial analysis and further discussions with participants, the unit of analysis was individual participant's partnership activity. The authors collected this data from multiple sources.

Yamagata-Lynch and Smaldino (2007) prepared Fig. 4.9 as a document to share with participants; thus, they included explanations to each of the observed tensions. In the activity systems portion of the figure the subjects were partnership participants, which



Identified Tensions

Facilitating Effective Communication
There are communication challenges between NIU and the partnership schools, liaisons and university partnership staff, liaisons and university faculty, among university faculty, and between schools and parents. These areas of difficulties were brought upon by lack of established communication channels that support partnership activities.

Balancing Theory and Practice
Teachers from partnership schools want professional development opportunities that provide them with just in time information regarding new pedagogical techniques based on sound theory. At the same time spending a lot of time on theoretical concepts is not a good use of teacher time. On the other hand, university faculty tend to value more theory and less practice.

Winning Stakeholder Commitment
There is a lack of stakeholder "buy-in" or commitment that makes partnership responsibilities difficult to accomplish. These stakeholders included NIU faculty, preservice teachers, inservice teachers, district administrators, and parents of K-12 students.

Fig. 4.9 Activity systems analysis results from Yamagata-Lynch and Smaldino (2007). Reprinted with permission of Elsevier. Yamagata-Lynch, L. C., & Smaldino, S. (2007). Using Activity Theory to Evaluate and Improve K-12 School and University Partnerships. *Evaluation and Program Planning*, *30*(4), 364–380. doi:10.1016/j.evalprogplan.2007.08.003

included both K-12 and university personnel. Their shared object was to prepare qualified teachers, develop professional pride, and engage in collaborative research. The tools that the participants relied on were teachers, the clinical placement office at the university, the university partnership office, university faculty, allotted budget, and documents regarding the partnership generated by the university. The rules that guided this shared activity included the partnership agreement, pre-service teacher education course requirements, school district requirements, teacher certification requirements, and university faculty workload. The identified community was the partnership participants. The shared divisions of labor the participants identified were teacher candidate placements, teacher liaison responsibilities, and faculty involvement in teacher training.

The tensions that existed in this activity were related to facilitating effective communication, balancing theory and practice, and winning stakeholder commitment. Communication between the K-12 schools and university were challenging because no paths had been established to support effective discourse. Balancing theory and practice is always challenging when teachers and faculty work together because teachers tend to value practice over theory and faculty tend to value theory over practice. Finally, winning stakeholder commitment can be difficult when not all stakeholders, including faculty, teachers, district administrators, parents, and K-12 students, were fully aware of the partnership activities.

As a result of this work, Yamagata-Lynch and Smaldino (2007) found that activity systems analysis can alleviate communication difficulties between school and university partnership efforts caused by cultural differences across multi-organizational boundaries. They were able to facilitate a productive discussion among a group that for years had difficulty communicating with one another. Furthermore, they were able to work with participants to strategize specific tasks that will help minimize the effects of identified tensions. This work demonstrated how activity systems analysis can be used as an analytical tool by both investigators and participants for facilitating communication and for understanding the complexities involved in inter-organizational activities such as K-12 school and university partnerships.

Implications from Various Activity Theory Studies

The most important observation of this chapter is that there is not a consistent method for engaging in activity systems analysis; however, researchers and practitioners can take a systematic approach for engaging in activity systems analysis. In the examples discussed in this chapter, activity systems analysis played a critical role in identifying systemic contradictions and how those contradictions affected participants' daily activities by introducing tensions. In many cases, these systemic contradictions and tensions were rooted in the social practices within a community that are difficult to identify and describe with other analytical methods.

The purpose for using an activity systems analytical method can be to achieve a descriptive analysis or for an action research oriented approach intended to bring about change in practice. Researchers and practitioners who choose to use this methodology need a strong background in qualitative data collection and analysis because prior to engaging in activity systems analysis they must conduct some type of thematic or discourse analysis of the data. At this stage, researchers and practitioners can choose to use Mwanza's (2002b) Eight-Step-Model as a prompt for identifying these themes, or identify the themes independently through a thematic analysis such as the constant comparative method (Strauss and Corbin 1989) and map those themes to the model later. As represented in the examples, the results from activity theory research can have solely research implications or both research and practical implications.

Chapter 5
Qualitative Research in Activity Systems Analysis

Keywords Qualitative research methods • Trustworthy activity theoretical research methods

When researchers and practitioners engage in investigations using an activity theory framework, they need to follow sound qualitative research methods. An investigator can arrive at meaningful and trustworthy activity theoretical conclusions only if s/he has a comprehensive data set that represents authentic participant experiences. The results of activity theory research cannot be of high quality if the investigator does not engage in sound qualitative research. Therefore, it is critical that researchers and practitioners are as well versed in qualitative research as they are in Cultural Historical Activity Theory (CHAT).

The purpose of this chapter is to provide an overview of qualitative research methods that conform to the naturalistic inquiry paradigm as it applies to activity theory research. This discussion will help researchers and practitioners develop an understanding of how to engage in future investigations. Additionally, I will provide a discussion specifically on case study research. Although activity theory researchers and practitioners can engage in various forms of qualitative research, I find that case studies are particularly compatible with the theoretical assertions and analytical intentions involved in activity systems analysis. The discussion on case study research will contextualize activity systems analysis within a specific type of qualitative approach and provide background information in preparation for the following chapter that presents an in-depth account of a CHAT comparative case study.

Qualitative Research and Naturalistic Inquiry

Qualitative research focuses on understanding and making meaning about a phenomenon in context (Merriam 2009). It is an open-ended method with a rich history that accommodates to different types of research approach for professionals

L.C. Yamagata-Lynch, *Activity Systems Analysis Methods: Understanding Complex Learning Environments*, DOI 10.1007/978-1-4419-6321-5_5,

in many social science disciplines (Denzin and Lincoln 2005). Creswell (2007) compares five qualitative research approaches including narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research that are all a variation within qualitative research. Many of these qualitative approaches share similarities, but there are salient features that make each distinctly different from the others and affect the ways in which an investigator would frame his/her research question, data collection, and analysis.

Within the history of the development of qualitative research, Lincoln and Guba (1985) introduced naturalistic inquiry as an alternative mode of research for social scientists to consider in place of quantitative research. Lincoln and Guba identified 14 characteristics of naturalistic inquiry that have become heavily integrated into various forms of qualitative research practiced today. Table 5.1 summarizes these characteristics and identifies how each characteristic relates to five aspects of a qualitative research I have identified as investigator role, participant selection, data collection, data analysis, and trustworthiness.

Table 5.1 Lincoln and Guba's (1985) 14 characteristics of naturalistic inquiry and five aspects of qualitative research

	Characteristics	Related aspects
1	The study takes place in a natural setting in which the investigator develops a rich understanding of participant perspectives/realities in the original context.	• Participant selection • Data collection
2	The investigator assumes the role of a highly adaptable data collection instrument while observing and interacting with participants. S/he stays attuned to the changes that occur during the study and modifies data collection procedures as necessary.	• Investigator role • Data collection
3	The investigator ensures that both his/her intuition and observations help develop a rich understanding about participants in the natural setting.	• Investigator role • Data collection • Data analysis
4	The investigator relies on qualitative data collection and analysis rather than quantitative methods exclusively.	• Data collection • Data analysis
5	The investigator implements purposive sampling to gain access to a full range of participant perspectives and experiences.	• Participant selection
6	The investigator engages in inductive methods of data analysis to identify participant experiences and how the investigator's preconceived values before, during, and after entering the natural setting affect the interpretive process.	• Investigator role • Data analysis
7	The investigator engages in thematic analyses of the data to let it speak for itself rather than setting an a priori hypothesis.	• Data analysis
8	The investigator engages in an emergent research design and lets data collection processes emerge as participants' experiences in the natural setting become increasingly familiar.	• Investigator role • Trustworthiness
9	The investigator negotiates the outcomes of the study with participants by presenting the findings to them and obtaining reactions.	• Trustworthiness

(continued)

Table 5.1 (continued)

	Characteristics	Related aspects
10	The investigator provides a thick description of his/her observations for the readers to decide what value the report brings to their work.	• Data analysis • Trustworthiness
11	The investigator does not make generalizable claims, but instead reports findings that are particular to the situation in the natural setting.	• Data analysis
12	The investigator appreciates and communicates the tentative nature of his/her findings that may be unique to the particular situation in the natural setting.	• Data analysis
13	The investigator identifies a clear focus in the study that is guided by the research question.	• Data collection • Data analysis
14	The investigator identifies, applies, and reports the procedures taken to ensure trustworthiness.	• Trustworthiness

Investigator Role in Activity Theory Grounded in Naturalistic Inquiry

The role of an activity theory investigator is to vicariously experience, make sense of, and become able to report participants' lived experiences. The investigator learns about participant experiences by becoming a highly adaptable data collection instrument in the natural setting (Lincoln and Guba 1985). As a human instrument, investigators enter the field with an open mind and develop an emic, or insider, perspective while relying on prior knowledge about the research site with an etic, or outsider, perspective for contextualizing observed activities within a larger context (Fetterman 2009).

In this data collection process, investigators constantly evaluate how interpretations of observations in the natural setting are being influenced by their personal values. At the same time, investigators need to evaluate whether they have lost sight of the outsider perspective as they acclimate to participants' cultural practices and it becomes far less difficult to understand participant experiences. Therefore, while in the field and engaging in the emergent data collection and analysis, investigators conscientiously take note of how their emic and etic perspectives affect their interpretations of participant experiences in the field (Lincoln and Guba 1985). This conscious effort is necessary for maintaining trustworthiness and rigor throughout the investigation.

While developing an emic perspective, an activity theory investigator needs to consider his/her role in the study. Glesne and Peshkin (1991) introduced various roles that investigators can take by referring to the participant-observer continuum. Glesne (2005) has continued to update this concept and continuum begins with "observer" on one end and "full participant" on the other end, as shown in Fig. 5.1. According to Glesne (2005), an observer follows the traditional social scientist role

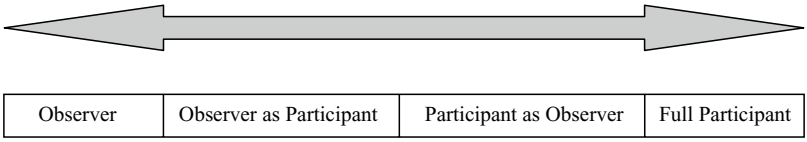


Fig. 5.1 Participant observer continuum based on Glesne (2005)

and positions him/herself at a quiet, unobtrusive location in the field and records observations while attempting to not interfere with participant activities. Though still primarily a distanced observer, they have some interaction with participants in the field. When investigators assume the role of participant as observer, they regularly interact with participants, but carry a primary role as investigators visiting the participants' community. When investigators assume the full participant role, they become or already have been a member of the participant community and simultaneously take the role of the investigator. In these situations, full participants view the primary role of the investigator as a community member who happens to be conducting a study of the everyday activities of that community. Some works make a distinction between participant observer and collaborative partner by clarifying that when investigators are participant observers the participants may not know that the investigation is taking place; however, when investigators assume the role of collaborative partner the investigation is fully disclosed to participants.

The continuum does not imply that investigators should commit to one role during an entire study. Glesne (2005) makes a point that during a long-term project the investigator's role may change as the study progress. For example, an investigator may enter the field as an observer or observer as participant, but over time his/her participation level may increase and the participants may choose to adopt the investigator into their community as a participant as observer. Marken (2006), introduced in Chap. 4 of this book, found himself in a situation similar to this. Marken entered the field initially as a participant as observer of a global marketing and training department at a large multinational corporation. He played a dual role as consultant and investigator to help prepare a training program for an affiliate organization in Japan. By the end of the investigative cycle, Marken became a full participant in charge of implementing the training program in Japan.

Figure 5.2 offers an activity theory perspective of how the participant observer continuum affects the ways in which investigators experience participants' everyday activities. As observers, investigators will experience participant activities by witnessing those activities during the course of an investigation. There is no overlap between investigators' and participants' activities; therefore, investigators' inferences about participant activities lack first-hand knowledge of what it is like to be a member of the participant community.

It is likely that the results of a study in which investigators were observers as participants will be reported predominantly from an outsider perspective. An observer as participant may sporadically engage in participant activities that are

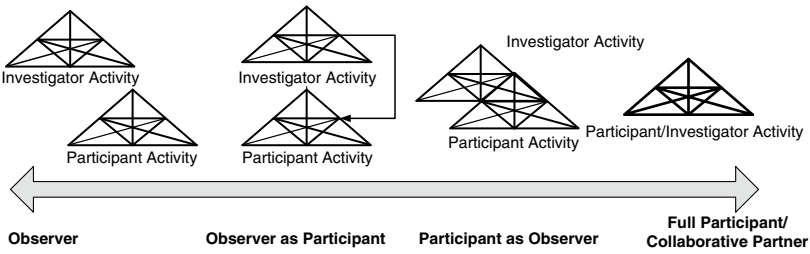


Fig. 5.2 Participant observer continuum from an activity theory perspective

peripheral to the participants' object-oriented activities. Investigators will primarily assume the role of the person conducting a study about participants, but will occasionally engage in small tasks in the field that may be goal-directed actions relevant to the object-oriented activities of interest. These experiences will provide investigators with limited first-hand knowledge of participant activities.

Investigators who assume the role of participant as observer will be highly engaged in the participants' everyday actions related to the object-oriented activities; however, they will maintain their role as an investigator. These investigators will acquire a rich collection of first-hand knowledge about participant experiences. There may even be times when participants comment that they forgot that the investigator was an outsider, but there will be defining moments during data collection and analysis when both investigators and participants will be reminded that the investigator is indeed an outsider.

As a full participant or a collaborative partner, investigators are insiders who are conducting an investigation of participants' goal-directed actions and object-oriented activities in the shared activity setting. The investigators' daily actions will have purpose and contribute to the object-oriented activities of interest and his/her participation will be difficult to separate from the investigation.

When deciding what role to take in naturalistic inquiry with an activity theory framework, investigators need to be aware of the costs and benefits that their role potentially may play during data collection and analysis. The best method to gain first-hand knowledge of participant experiences is to become a full participant in the community. This role may provide investigators with access to information that participants feel comfortable sharing only with their peers. By becoming full participants, investigators can learn how to see the world from the participants' vantage point. However, if there is worry that the investigators' participation could compromise the ability to collect meaningful data that is essential to the research questions, then they ought to consider taking an observer role. Just as there is information that participants feel comfortable sharing only with "insiders," there may be information that they are comfortable sharing only with "outsiders." Therefore, investigators can decide what role to take on the participant observer continuum after weighing the costs and benefits (Glesne 2005).

Setting, Participant, and Activity Selection

To ensure that investigators do not lose focus on the research question during data collection, they need to create a set of criteria for identifying who, what, and where to engage in data collection (Merriam 2009). These criteria play an important role in activity theory research because investigators may be able to adjust the focus of a study during its course, and the people, activities, and artifacts they choose to examine will affect the subsequent potential access to other data sources. Additionally, qualitative research typically has a small number of participants; therefore, it is important that the participants and the participant experiences an investigator chooses to examine indeed provide information that is relevant to the research question (Miles and Huberman 1994). Several qualitative researchers have provided advice on issues to consider when identifying the selection criteria. Their advice includes these recommendations:

- Collect data on both typical and unusual participant experiences to gain a full range of information (Lincoln and Guba 1985; Miles and Huberman 1994; Stake 1995).
- Ensure that the criteria are theoretically informed and use the research question as a guide for developing the criteria (Denzin 1989; Fetterman 2009).
- Recruit participants who are amenable to being included in the study (Stake 1995).
- Identify specific characteristics that will help find people who are good candidates to include in the study (Merriam 2009).
- Recruit participants who are likely to be able to suggest other people to recruit for the study and other interesting events to examine (Miles and Huberman 1994).
- Design participant selection criteria that accommodates to the emergent design of qualitative research and allows for adding new participants during the study as the investigator spends more time in the field (Lincoln and Guba 1985; Miles and Huberman 1994).

The investigators' strong theoretical background and practical knowledge about the setting play a critical role when identifying the selection criteria for setting, participant, and activity. The investigators' theoretical knowledge has to be conceptually dense to be able to identify criteria that will help capture the multifaceted nature of the complex human activity they are investigating (Strauss 1987). This theoretical knowledge enables investigators to see a phenomenon from a specific perspective and guide the fine-tuning process for the research question, data collection methods, and data interpretations (Denzin 1989; Merriam 2009; Yin 2009). The investigators' practical knowledge about the setting helps them to avoid reckless and thoughtless data collection.

Once in the field, investigators may become overwhelmed with the abundant information and events that can be potential sources of useful data. Investigators cannot afford the time or the effort to collect information that may have no application to their studies because they have limited time in the field, and participants have

limited time and patience for a study. Therefore, after considering the theoretical and practical issues, investigators need to feel confident that their selection criteria will allow them to (a) gain access to participant experiences that are most relevant to the study, (b) step into the participants' world, and (c) explain the phenomenon in activity theory terms.

When selecting a setting in which to engage in an activity theory study, investigators need to be aware of the differences between the overall setting and activity setting. The overall setting in qualitative research is usually the physical location in the field where the investigation takes place. In CHAT research, the activity setting is the location that the participants' object-oriented activities take place. It is an environment where participants have common goals and are bound together by the actions and activities in which they engage (Gallimore and Tharp 1990). The setting that the investigator chooses to conduct a study most likely will not represent the entire activity setting where participants engage in object-oriented activities because activities settings are not necessarily bounded by the physical environment. Instead, activities settings can cut across multiple organizational boundaries that encapsulate the object-oriented activities under investigation.

It is unlikely that investigators will be able to identify the activity setting for a study until they gain an insider perspective of the field. Therefore, when selecting the overall setting, investigators assess whether the initial study site will let them observe actions and activities that will help them identify and learn about the activity setting. The selection criteria for the setting should be broad and open-ended to provide room for investigators to discover the activity setting as the study progresses. At the same time, the broad criteria about the setting need to have sufficient focus so that investigators are able to narrow the scope of the study to ensure that they collect data that is relevant and essential to the research question.

Before entering a new site, investigators need to build a strong sense of familiarity with the setting (Denzin 1989). From an activity theory point of view, investigators should have answers to the following questions about the setting:

- What are typical activities in the setting?
- What activities tentatively seem relevant to the research question?
- Which participates are engaged in activities relevant to the research question?
- What existing documents and artifacts seem relevant to the study?

Data Collection

In qualitative research, investigators are the human data collection instrument (Lincoln and Guba 1985). The experiences that investigators gain from the field are the data that helps them gain an understanding of participants' everyday activities. These experiences guide investigators to gain a new sense of the world from the participants' perspective. As the research instrument, investigators systematically address the research question and record information as it is collected in the field.

Investigators need to be highly adaptable to situations as they unfold while progressively gaining more access to participant experiences. To implement appropriately focused and balanced adaptations to the data collection methods, investigators reflect on how their etic perspective, emic perspective, and personal background are affecting the study. Thus, in order to serve as an effective human data collection instrument, investigators need skills to

- Tolerate ambiguities while engaging in data collection (Merriam 2009).
- Be a good communicator (Merriam 2009).
- Change course in data collection when one path does not help gain new meanings (Stake 1995).
- Adapt data collection methods by examining and maintaining a balance among an etic perspective, emerging emic perspectives, and personal background; and
- Examine the research question as the study progresses and make adaptations to it as new understandings emerge from the ongoing data collection and analysis experiences (Lincoln and Guba 1985).

As it was the case for determining the criteria for research setting, participants, and activity selection, initially investigators rely on their theoretical knowledge and practical knowledge about the research site to identify appropriate data collection methods. The investigators' ability to engage in data analysis and find interesting information are both directly affected by the quality of the data they collect (Corbin and Strauss 2008). Therefore, investigators need to maintain a clear focus throughout data collection guided by the theoretical framework and research question (Lincoln and Guba 1985).

Data Collection Methods

Data collection methods used by qualitative researchers include interviews, observations, and document analysis.

Interviews provide information about the participants' natural setting in their own words. Interviews can be structured, semi-structured, or open-ended and be facilitated in individual or group formats. Interview results can provide investigators with new information about the natural setting that is not accessible through observations and verify the accuracy of observations (Merriam 2009). Investigators ensure interview participants that their anonymity is secured and are sensitive to what participants are comfortable or not comfortable in discussing. Interviews can also help identify how participants view their own experiences and bring attention to idiosyncratic language, cultural practices, and artifacts with symbolic significance that are embedded in participants' everyday activities (Fetterman 2009). Interview participants may also introduce investigators to other potential study participants. From an activity theory perspective, interviews help identify information about the subject, existing or lacking tools, and the subjects' perspectives about the object. Participants may also share information regarding documents and artifacts

that relate to existing rules and division of labor. It is also likely that participants will be able to provide information about the communities in which their activities are situated.

Observations can be time consuming and overwhelming; however, they provide investigators with first-hand experience of participants' everyday activities (Merriam 2009). From an activity theory perspective, investigators need to observe situations in which participants are engaging in goal-directed actions and object-oriented activities relevant to the study. Initially, it is more likely that investigators will encounter a series of goal-directed actions that may or may not be relevant to the object-oriented activities of interest. There may be a series of object-oriented activities taking place across a long period and involve multiple participants in different locations. Thus, it may be difficult to pinpoint one observation event as the entirety of object-oriented activities. However, through observations and interviews investigators will be able to see the greater context and how everyday goal-directed actions fit into the object-oriented activities under investigation.

Documents or artifacts that investigators choose to analyze are often produced prior to the study for purposes that may have no connection to the investigation. Thus, investigators need to learn where to find documents and artifacts that are authentic, accurate, and relevant to the study (Merriam 2009). Document and artifact analysis often provides new contextual information that explains and verifies what investigators learn from interviews and observations. In my own experience, I have found that documents and artifacts such as policy manuals, newsletters, and participant-created materials help me gain an understanding about the rules and division of labor that influence participant engagement in everyday activities. Tracking policy manuals and newsletters over time can help investigators learn more about the participant community because these documents often reflect the participants' established collective decisions related to how they identify their community.

Data Analysis

Qualitative activity theory data analysis is an inductive process that leads to a thick description of participants, their activities, and the activity setting. By providing thick descriptions about a study investigators can help the audience/reader gain a participant perspective and vicariously experience participant activities. Thick descriptions involve investigators sharing participant experiences including rich contextual information as well as key raw data from observations, interviews, and document analysis (Geertz 1973).

Qualitative data analysis may rely on inductive reasoning, but it does not lack systematicity (Merriam 2009). In data analysis, investigators reorganize their field-based data (Glesne 2005). I have always approached data analysis as an opportunity to find my participant's story. Thus, in the data presentation I write my report as if

I am telling my participants' story to the reader. This story telling is not based on fiction, but is instead a result of a constant reexamination of the data while comparing and contrasting multiple sources and finding an accurate, credible, and trustworthy story that the data is ready to share with others.

There is already a rich collection of literature on qualitative data analysis, thus I will not reiterate all of the existing discussions; however, I will introduce basic discussions regarding the inductive yet systematic process involved in data analysis. While there is more than one approach to engaging in qualitative data analysis, my discussions will heavily rely on the constant comparative method discussed in Corbin and Strauss (2008), Strauss and Corbin (1998), Strauss (1987), and Glaser and Strauss (1967), Please note that Corbin and Strauss (2008) and Strauss and Corbin (1998) are two editions of the same book, but because Corbin and Strauss (2008) was written by Corbin after Strauss's death I find significant differences between the two editions.

I see my role in data analysis as a facilitator who puts the participants' story into words. In this role, I assume the responsibility to organize the data in a manner that allows others who read my work to understand the participants' experiences. In activity theory research, this role as a story teller is important because the activity systems analysis is based on this story. Therefore, in my own work I strive to provide a thorough account of how I engaged in the qualitative data analysis process and provide a thorough narrative that summarizes participant experiences. Without this narrative or thick descriptions of the data, the reader will have nothing to use as a source for engaging in their own activity systems analysis of the data to assess the trustworthiness of the investigator's work.

The goal of data analysis in qualitative research is to identify data sources that are relevant and essential to the study topic (Fetterman 2009). This involves taking the raw data and identifying conceptual meanings (Corbin and Strauss 2008). In this process investigators convert raw data into a form that can be communicated with others who did not have any contact with participant experiences or the activity setting.

Activity theory investigators may feel as if they are drowning in data and are afraid of losing focus during data collection and analysis. In qualitative research, investigators do not refine their data collection to units of relevant and essential variables prior to data collection; instead, they refine data during and after data collection (Lincoln and Guba 1985). Investigators engage in data analysis that provides evolving interpretations of their observations (Strauss 1987). In this process, it is always difficult to make judgments about what sources may be relevant and meaningful to the investigator's work.

In my experience, data analysis is a defining moment. No matter what role I take in the study on the participant-observer continuum, for purposes of data analysis I clearly need to take the investigator role. Unlike a participant, during data analysis investigators need to force themselves to break the data into analytical units (Strauss 1987). Investigators need to go back to the research question and use it as a vantage point for re-experiencing the data and prepare thick descriptions of those experiences from the investigator perspective.

The Constant Comparative Method

The constant comparative method is a systematic qualitative analytical method introduced by Barney Glaser and Anselm Strauss in the 1960s (Glaser and Strauss 1967) as a component of grounded theory development Since their original conception, they have both written books on grounded theory; however, in 1992 Glaser wrote that Strauss no longer understood grounded theory development in the form that they both conceived in the 1960s. Strauss's publication focused more on applying the constant comparative method to qualitative data analysis in general and not necessarily to grounded theory development exclusively. Glaser (1992) criticized Strauss and Corbin's work in 1990, which provided a step-by-step approach to the constant comparative method. Glaser feared that Strauss and Corbin's approach encouraged investigators to force and legitimize their preconceptions about their study during data analysis.

The constant comparative method engages investigators in an intense, systematic process of examining and reexamining the data while comparing one source with another to find similarities and differences (Glaser and Strauss 1967). It begins with open coding. This stage of coding involves an intense microscopic examination of data that helps investigators identify the complexities involved in participant activities (Strauss 1987). During open coding, there are no restrictions to what investigators code, if there is a glimmer of a possibility that a particular set of text or participant comments are relevant to the study then investigators make a notation and code the data (Strauss 1987; Strauss and Corbin 1998). In this process, I always try to code data in the smallest unit possible. In other words, if a body of text or participant comment represents characteristics that fit more than one code, then I question myself whether it is an instance of the data truly representing characteristics of more than one code or whether it can be parsed into smaller units of data.

At this stage, investigators code data, often in text-based format on paper or with a qualitative research software. On paper, investigators can create extensive margin notes, or use adhesive note paper such as Post-it Notes. I often import data such as field notes, interview transcripts, and documents, including participant-created materials in electronic formats, into a qualitative data analysis software such as Nvivo. I have also simply used word processors and their commenting feature for recording margin notes.

Along with the coding process, every time investigators find a new code or gain a more developed understanding about a code, they stop coding and take note of the definition (Glaser and Strauss 1967). I always try to be meticulous about writing down the definition of a code as clearly, concisely, and accurately as possible. The definition needs to be clear so that it makes sense to others when working on team investigations, but also because the code definitions become the starting point for phrases included in the thick description of the data in narrative format. The definition needs to be concise so that the characteristics of one code do not overlap with another. Finally, the definition needs to be accurate because if it is not then the subsequent analysis will be inaccurate and untrustworthy.

The codes and definitions that investigators uncover during open coding are tentative, thus investigators keep an open mind about them and are able to conceptually step back from their codes and question their relevance to the study (Strauss 1987). Investigators need to be willing to change code names and definitions as often as necessary as they examine and reexamine the data. In the conceptual stepping-back process, I have found that not all of the initial codes from the open coding become code worthy by the end of the data analysis. In these situations, there have been times when I have eliminated the irrelevant code entirely or merged it with another code that describes the characteristic of the phenomenon under investigation. After I refine the initial codes, I create a code and definition table that is descriptive as possible, then I examine all of the codes and definitions and make sure that they are mutually exclusive.

There are activity theory researchers who use pre-specified activity theory codes during open coding. For example as discussed in Chap. 4, Mwanza (2002a) used the Eight-Step-Model that addressed specific components in an activity system. I prefer to keep open coding as open as possible. I focus my energy at this stage of the analysis on identifying a set of mutually exclusive codes with sound definitions that I am able to provide evidence for from the data set while maintaining a balance between my experience with participants and my theoretical knowledge. This is when I fine tune my perspective of viewing the world from the participants' eyes and avoid focusing on participant experiences that only map well with theoretically driven codes.

Open coding continues until investigators can no longer find new codes within the data. This is an indication that the data is saturated and that it is time to stop coding and begin looking for larger categories of themes that are cutting across the data set (Glaser and Strauss 1967). However, especially when working with a team of investigators, even if the data may seem saturated to one investigator another investigator may find more codes. There is nothing wrong with this as long as the team does not lose focus on their investigation and they are not just coding for the sake of coding.

The second step in the constant comparative method is axial coding. Axial coding involves an intensive analysis of the categories of codes that were identified during open coding (Strauss 1987; Corbin and Strauss 2008). Investigators engage in an analysis that "revolves around the 'axis' of one category at a time" (Strauss 1987, p. 32) to discover its relationship with other codes, family of codes, and sub-family of codes and gain a more meaningful and accurate knowledge of the data set. At this stage, investigators identify overarching themes and categories that exist among the codes.

For example, investigators may identify codes that are related to participants' background information as a family of codes. Another family of codes might be those that are related to specific participant activities and another might be those that are related to the type of human relationships that participants share in the activity setting. After investigators uncover these families of codes, they may find that the data set reveals that participants who engage in one type of activity often share similar backgrounds. At this point, an investigator is not looking for correlational relationships in a statistical sense, but instead they are identifying how families of codes interact with one another based on what the data suggests.

At the end of the open coding process, investigators have a rough draft of the relationships among codes and can begin axial coding. During axial coding, investigators often find codes that they did not identify in open coding, codes that need

to be eliminated, or definitions that need to be refined. These coding processes are often explained in sequential stages for clarity purposes, but in actuality investigators often engage in more than one coding process in any given time (Corbin and Strauss 2008).

Selective coding is the final coding process in the constant comparative method. During selective coding, investigators code the data systematically around the core family of codes that are most relevant and carry the message about what the investigator learned from the study (Strauss 1987). As an activity theory qualitative researcher, this is when I ask the following questions:

- What are the key activities related to this study that are in the data set?
- What is the activity setting in which these activities are situated?
- Who are the subjects of these activities?
- What is the shared object of these activities?
- Do different subjects participating in the same activity view the activity and the object differently? If yes, why?
- What tools, rules, community, and division of labor are involved in these activities?
- What systemic contradictions are bringing tensions into these activities?
- What are the outcomes of these activities?
- What historical relationship does one activity have with another?
- How does one activity interact with another?

Depending on the nature of the data, investigators may find more questions to ask themselves during selective coding. In my own work, I begin drafting activity systems models by identifying the themes that fit into the subject, tool, object, rule, community, and division of labor elements related to the study during selective coding. These models continue to be drafts until I write the thick description of the data in narrative format. I usually write the narrative by going back to the codes and examining the draft models, but invariably the narrative writing process involves a new stage of analysis and I make additional changes to the models.

Maintaining Trustworthiness

Established Methods for Maintaining Trustworthiness in Qualitative Research

Trustworthiness in qualitative research requires that the investigator purposefully attend throughout the research process to these questions posed by Lincoln and Guba (1985):

> How can an inquirer persuade his or her audience (including self) that the findings of an inquiry are worth paying attention to, worth taking account of? What arguments can be mounted, what criteria invoked, what questions asked, what would be persuasive on this issue? (p. 290).

Activity theory qualitative researchers need to question themselves during every step of their studies and, when they have answers to these questions, record them in the methodology sections of their reports. Strategies that have been identified by several authors to maintain trustworthiness in qualitative research include prolonged engagement in the field, persistent observations, triangulation, creation of a study database, maintenance of a chain of evidence, peer debriefing, and member checking.

Prolonged engagements require investigators to spend sufficient time in the field to be immersed into participants' daily activities and cultural context (Lincoln and Guba 1985). The more time that investigators spend in the field the more likely it is that they will build the essential relationships necessary to gain access to multiple sources (Glesne 2005). However, the concept of prolonged engagement is a relative term. Some investigators may choose to spend 2 years at a study site in a longitudinal study; others may investigate a specific set of activities related to a short term project. Additionally, prolonged engagement does not ensure that investigators will work with the same set of participants the entire time of the study. For example, in a school setting, students move from one grade to another between school years; therefore, each investigator needs to determine how much time in the field would qualify as prolonged engagement for the purpose of the study.

Persistent observation brings back focus to the immersion experience that investigators gain from prolonged engagement (Lincoln and Guba 1985). As investigators build their knowledge about participants, participant activities, and setting, they identify the experiences within that setting that are relevant and essential to the study. To avoid premature study closure, Lincoln and Guba advise that investigators pay attention to experiences that are obviously related to the study as well as those that are seemingly unrelated yet upon further investigation may be related. Maintaining a focus during data collection is not a clear-cut process; investigators need to remind themselves of the study focus, making sure that they do not lose site of the research question or engage in reckless data collection.

Triangulation is a well-discussed strategy for maintaining trustworthiness in qualitative research. It involves collecting data from multiple sources (Corbin and Strauss 2008; Denzin 1989; Glesne 2005; Lincoln and Guba 1985; Yin 2009). Denzin (1989) introduced four types of triangulation processes: data triangulation, investigator triangulation, theory triangulation, and methodological triangulation. Data triangulation requires investigators to be sensitive to obtaining data from multiple sources from different time settings and space. Investigator triangulation requires investigators to work with multiple investigators during data collection and analysis. Theory triangulation requires investigators to interpret data from the theoretical framework they relied for the study. Finally, methodological triangulation requires investigators to gather data using more than one strategy.

A study database is an organized data file that investigators prepare that is separate from the final report of the qualitative study (Yin 2009). This type of database helps investigators to not only be organized, but also be systematic in the way they approach the study. In my own work, the study database has helped me build evidence-based claims about my studies and report them in my writing or presentations

with essential raw data to support them. I find that by the time I am writing a study report, if the results of the data collection and analysis are not properly recorded in an organized manner I lose the ability to locate essential evidence to include in the report and I become ineffective at writing the findings. The study database has also helped me during data analysis when working in a research team because it allows the team to quickly gain access to data to share with one another. The team can then record individual and group interpretations of the data to add to the database. The database can be in electronic format, paper format, or both. In either case, I usually create a tagging system for file names, color coding for physical objects, and a meticulous filing system on my computer and in a physical file cabinet so that I am able to locate data and analysis results effectively.

Maintaining a chain of evidence means that investigators provide the information necessary for an external observer/reader of a qualitative research report to trace the investigators' steps from the research question to the conclusions (Yin 2009). This allows the reader to assess how the investigators' judgments and methodological procedures at each step of the study affected the results. Depending on what role investigators take on the observer-participant continuum, the influence this information has on the readers' appreciation of the particularities of a studies will vary, but investigators need to document a clear trail of decisions they made regarding the study and methodological procedures.

Peer debriefing requires investigators to find a colleague who was not involved in the study and introduce him/her to the study and preliminary analysis results (Lincoln and Guba 1985). In this process, investigators may have to prepare a mini-report for the peer to examine. I have found that this report creation activity alone helps me commit to an initial set of evidence-based findings.

Member checking involves presenting the data and analysis results to members and stakeholders of the participant community (Lincoln and Guba 1985), allowing investigators to test the authenticity of findings with participants and members to elaborate on an observation or the investigator's interpretations of findings. If a member disagrees with an observation that investigators present, it does not necessarily mean that it was an erroneous observation. There could be findings that only investigators can see because of their theoretical knowledge and outsider perspective. Therefore, after member checking sessions, investigators need to carefully examine the value of findings with which participants disagree and, if necessary, describe in their reports those findings that were not in agreement with participants.

Maintaining Trustworthiness in Activity Systems Analysis

The first step toward maintaining trustworthiness in activity systems analysis is indeed to maintain it during the qualitative data collection and analysis, but investigators need to maintain trustworthiness while generating the data-based activity systems model as well. Activity systems analysis is still a relatively novel analytical

method, and there are no agreed-upon strategies for maintaining trustworthiness. In my own work, I have attempted to meet Schoenfeld's (1992) standards for investigators using novel methodologies:

1. Establish the context; describe the issues to be addressed.
2. Describe the rationale for the method.
3. Describe the method in sufficient detail that readers who wish to can apply the method.
4. Provide a body of data that is large enough to allow readers to (a) analyze it on their own terms to see if their sense of what happened in it agrees with the author's, and (b) employ the author's method and see if it produces the author's analysis.
5. Offer a methodological discussion that specifies the scope and limitations of the method, as well as the circumstances in which it can profitably be used, and that treats issues of reliability and validity (p. 181).

Standards 1, 3, and 4 are often addressed in qualitative research in general if authors are conscientious about providing thick descriptions and report on the methodology of the study; however, standards 2 and 5 are not necessarily addressed in all qualitative research. I have found that in order to meet journal word count requirements, for example, the methodological discussions that address Standard 2 and the thick descriptions that address Standard 4 are often where I have to eliminate text. Standard 2, related to describing the rationale for the method, is a discussion I often include in the literature review. This allows the entire report to be focused and helps justify how the methodology is appropriate for investigating the research question. Standard 5, related to the discussion of the strengths and weaknesses of the methodology and the reliability and validity issues, is a discussion I often include in the conclusion of a report. Therefore, in all of my activity theory study reports I typically include conclusions regarding the findings of the study and what I learned about the methodology.

Activity Theory and Case Study Research

Case study research is an appropriate qualitative methodology to pursue when the phenomena and related variables are impossible to separate from the context (Yin 2009). The goal of a case study is to truly understand a single case, and not to compare it with other cases in order to make general claims. By emphasizing the uniqueness of a case, the expected outcome of a case study is particularization and not generalization (Stake 1995). Thus, investigators aim to understand the relationship between the phenomenon, variables, and context within a specific bounded system.

Case study investigators objectively observe events in a naturalistic setting while recording the meaning of what they observe and when necessary redirecting

the observations to gain a better understanding of the phenomenon (Stake 1995). Similar to any other type of qualitative research, investigators can take the role of a silent observer by not participating in the events in the field, a participant observer by taking a role in the events in the field, or any other form of observer between the two. In most case studies that involve activity systems analysis, I have found that investigators take somewhat of a participant observer role as indicated in the studies introduced in Chap. 4.

In my own work, I have found that activity systems analysis is compatible with case study research because activity systems analysis involves the examination of self-sustained systems that are difficult to remove from the context and when investigators engage in data collection and analysis they need to be able to treat goal-directed actions, object-oriented activities, and activity settings as separate yet highly interrelated bounded systems. While engaging in data collection and analysis, the idea that case study involves the examination of clear and bounded systems in natural settings (Creswell 2007; Merriam 2009; Stake 1995; Yin 2009) brings an organizing framework to maintain focus.

Table 5.2 illustrates the conceptual compatibilities between activity systems analysis and case study research. In activity systems analysis the object-oriented activities, goal-directed actions, and activity settings are the bounded systems that investigators examine. Case studies do not have predefined type of bounded systems that investigators examine. From a theoretical perspective, activity theorists are specifically interested in identifying object-oriented activities; however, from a case study perspective, object-oriented activities, goal-directed actions, and activity settings can all be identified as a viable case to study. Additionally, as discussed in Chap. 2, from an activity theory perspective, when investigators are studying object-oriented activities as a bounded system, the system can be characterized from a personal, interpersonal, or community/institutional planes of analyses following Rogoff's (1995, 1998) three planes of sociocultural analyses.

In the following chapter I will present an in-depth example of a CHAT comparative case study involving a K-12 school and university partnership-based yearlong technology professional development program. By examining the study detail the readers will be able to identify how activity systems analysis and case study research complement one another to maintain trustworthiness in the study of complex human learning environments. This example will help readers design and engage in their future investigations.

Table 5.2 Activity systems analysis and a case study

	Activity systems analysis	Case study
Bounded system	Object-oriented activities, goal-directed actions, or activity settings	Case
Unit of analysis	Object-oriented activities that could be identified in the personal, interpersonal, or community/institutional planes	Case

Chapter 6
In-Depth Examples of Activity Systems Analysis Research

Keywords In-depth example • Activity systems analysis comparative case study

The purpose of this chapter is to share an in-depth account of a Cultural Historical Activity Theory (CHAT) comparative case study research using activity systems analysis in which I was engaged between 1998 and 2001. Several aspects of this study have already been shared with the professional community through conference presentations and peer reviewed journal articles. Some of the published works include Yamagata-Lynch (2003a, 2003b, 2007).

In this chapter, I will introduce detailed research methodological procedures, data collection instruments, analytical code development processes, and analyses of findings that have not been discussed in previous publications or presentations. To contextualize the methodological discussions in this chapter I will reintroduce selected excerpts of the data and analysis published in my past publications. This chapter will help researchers and practitioners design, develop, and implement future investigations of their own.

Study Background

For this study I examined the Teacher Institute for Curriculum Knowledge about Integration of Technology (TICKIT) a yearlong professional development that began during the 1998–1999 school year at Indiana University's School of Education in partnership with the Ackerman Family Foundation and in later years with the Arthur Vining Davis Foundation. Every year 25–30 teachers from five school districts participated in the program. The project lasted 5 years and we were able to support five cohorts of program participants. Though the funders changed during the life of this project, the program met its goal to assist rural Indiana K-12

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teachers and schools that received extensive state funding to integrate technology into their district-wide curricula.

During the 1998–1999 and 1999–2000 school years, I was a graduate assistant working with two Indiana University faculty project directors to design, develop, and implement the TICKIT program. During the 2000–2001 school year I was no longer a graduate assistant and was involved in the program as a researcher. I left Indiana University in 2001, and I no longer was involved in the daily operations of the program.

The TICKIT partnership was built on the shared responsibilities among teachers, school districts, and Indiana University staff. Once enrolled in TICKIT, teachers were responsible for completing two technology curriculum-integration lessons; participating in ongoing workshops provided by the staff both at Indiana University and at their schools; participating in online activities; and attending the Indiana Computer Educator's (ICE) conference where teachers, researchers, and people from the business sector presented their most current technology infusion school projects.

While TICKIT teachers were engaged in program activities, the school districts were responsible for providing to them hardware and software necessary to complete TICKIT projects, classroom Internet connections, release time to participate in workshops and the ICE conference, and monetary support for teachers to enroll in the program. TICKIT staff strongly believed that for teachers to successfully integrate technology into their curriculum, they needed appropriate hardware, software, and stable Internet connections. TICKIT participation requirements were compatible with the program requirements because many of the 1998–1999 TICKIT schools were recipients of the state technology grant. The grant ranged from $100,000 to $150,000, and each school was required to spend at least 30% of their awarded funds on teacher professional development.

The school district support requirements may seem minimal to us today, but during the late 1990s there were many rural schools in Indiana that could not meet these expectations. Some schools were conditionally admitted to TICKIT when the administrators submitted proof that their teachers would have hardware, software, and Internet access by the time the program began during the school year. Even so, there were times that TICKIT staff would contact school district administrators to make sure that teachers had access to the resources that had been promised in the application materials.

The TICKIT staff, which consisted of Indiana University faculty and graduate students, was responsible for conducting curricular technology integration workshops throughout the year that targeted teacher needs, moderating the program atmosphere to promote a comfortable environment for teachers to share ideas, and communicated with school district personnel when teachers were facing difficulties. The workshops that TICKIT staff offered included information on hardware, software, using the Internet as a classroom research tool, designing classroom hypermedia projects, and pedagogical issues surrounding technology use in education.

Study Description

During the 3 years I was involved in TICKIT as a professional development facilitator and researcher, I maintained contact with 1998–1999 teacher participants. Through these sustained interactions with teachers; I observed many situations where the first year TICKIT teachers encouraged other teachers from their schools to participate in the program. Additionally, these first year TICKIT teachers were willing to take leadership roles in their schools to spread curriculum technology integration into their colleagues' classrooms.

Observing these types of development over time, I became curious about whether TICKIT was acting as a catalyst for change beyond the individuals participating in the program. Existing research on teacher professional development programs indicates that there are already plenty of descriptive reports regarding university–school partnerships and their immediate development, but there is a lack of investigation into the lasting impact on schools and their teachers after the partnerships are terminated (Ishler et al. 1998). After considering what I observed in TICKIT and examining the literature on K-12 school and university partnerships and teacher professional development, I designed this study to address the question: How do teachers continue to use and develop new activities introduced in a year-long professional development experience after they complete the program?

I decided to engage in a CHAT comparative case analysis of school districts that participated in TICKIT during 1998–1999 and 1999–1998. I compared two school districts that shared similar local community backgrounds and were in similar stages of school-wide curricular technology implementation. The case comparison focused on TICKIT-related activities at the two school districts that helped to explain the common outcomes of the program. I examined the relationships formed by TICKIT, participating teachers, their colleagues, and their school districts as well as everyday teaching resources, formal and informal rules and regulations that affected teaching and participation in TICKIT, and the division of labor distributed among teachers and local staff in the districts.

I made several assumptions about this study from a CHAT perspective that influenced the research design. First, I identified TICKIT as a professional development program introduced to the participants' school activity setting and intended to be a catalyst for initiating new and desired curricular technology activities in the school districts. Second, the program was designed to encourage teachers to develop and share new perspectives and experiences related to technology integration with other members of their community. Third, I identified the anticipated new perspectives and experiences that teachers gain from TICKIT as artifacts that had the potential for being transformed into cultural tools. Fourth, I acknowledged that these cultural tools were intended to become resources designed to mediate change in teacher practice by integrating technology into the curriculum. Fifth, these artifacts were capable of dramatically affecting the way teachers view themselves, their social context, and the rest of the world. Sixth, I was aware that the artifacts could introduce new limitations at the same time that they freed older limitations (Wertsch 1998).

Seventh and therefore, I did not assume that the introduction of TICKIT into the teachers' everyday activities necessarily resulted in positive consequences.

Research Questions

While considering the study assumptions in an effort to guide the methodology I identified the following research question:

How did the participation of teachers in a yearlong professional development program (TICKIT) affect the transformation of newly introduced artifacts into cultural tools in the teachers' activity setting?

Additionally, to address this question I examined the following three closely related questions:

1. What is the nature of everyday teaching-related experiences of TICKIT teachers?
2. What artifacts introduced in TICKIT became influential cultural tools?
3. What ongoing activities exist that support the transformation of newly introduced artifacts to cultural tools?

I had two methodological goals for addressing the research question. The first was to capture data that would enable me to examine the role TICKIT played as an artifact that was introduced into the participants' activity setting. To fulfill this goal, I used data collection methods that captured data in the three planes of sociocultural analyses (Rogoff 1995; Rogoff 1998). In particular, this investigation focused on the interpersonal plane of analysis. Interview questions, observations, and document analyses were targeted to reveal the types of influence that TICKIT had on teachers' social interactions. I collected individual and community/institutional data as background information to clarify and understand teacher activity interactions. The second goal was to engage in a case study that resulted in petite generalizations (Stake 1995). To meet this goal, I gathered data to identify particularities about each case.

Case Selection

Sampling Criteria

I conducted a purposive sampling to narrow down possible cases for this comparative study to school districts with similar backgrounds. The criteria I used were (a) school districts that enrolled in TICKIT for both the 1998–1999 and 1999–2000 school years, and (b) school districts that provided ample support for teachers to successfully complete TICKIT requirements. Consecutive-year enrollment became

a criterion because I observed that of the five 1998–1999 participating school districts, one with a very different background from the others chose not to enroll in TICKIT for the second year. This school district had more technology resources and district technology support compared to the other participating first-year TICKIT schools, and after 1 year in TICKIT they had teachers willing to become technology integration leaders to help the entire district professional development efforts. In fact, this school district chose to carry out in-house TICKIT-like professional development, which was managed by the district technology coordinator. The second criterion, an ample level of school district support, was selected because during the first year, TICKIT staff found that the qualitatively different results in teacher technology curricular integration projects and the teacher completion rate of the program depended on the amount of support they received from their school district.

After sorting the five schools according to the first sampling criterion, there were three schools in the possible case pool. This was narrowed by the second sampling criterion to the two schools that had a much higher level of local support mechanism in place than the third school that had negligible assistance. The two schools selected as cases were assigned the pseudonyms Hillsdale-Berkley School District and Blackwell School District. I obtained participant consent to take part in the study following the university Institutional Review Board (IRB) requirements. These consent forms are included in Appendix 6.1. In the appendix, I have deliberately omitted personal information that was included in the consent form. At the time of this study, the two participating school districts did not have their own IRB process; it is likely that today school districts have their own processes, often monitored by the human resources department, and may also require investigators to complete a criminal background check prior to stepping into classrooms during school hours.

Participant Selection

Primary Participants

Primary participants were individuals meeting the following criteria (a) TICKIT 1998–1999 participants who were classroom teachers, and (b) TICKIT 1998–1999 participants who participated in the entire year long program. These primary participant-related criteria narrowed the number of teachers to four per case (eight eligible primary participants), though not all eight of these teachers agreed to participate in this study. Four teachers from the Hillsdale-Berkley School District and three teachers from Blackwell School District agreed to participate. All primary participants were Caucasian Americans. There were three female and one male primary participants from the Hillsdale-Berkley School District and three female primary participants from the Blackwell School District.

Secondary Participants

I identified non-TICKIT teachers, administrators, technology coordinators, and technology support staff as secondary participants. At the Hillsdale-Berkley School District there were five secondary participants, all female, including two teachers, one media specialist, one technology coordinator, and one technology support staff. At the Blackwell School District there were three secondary participants, two male and one female, including one technology coordinator, one technology support staff, and one classroom teacher. All secondary participants from both school districts were Caucasian Americans.

Researcher Role

During 2000–2001 when I was engaged in this study, for the most part I took an investigator role that can be described as observer as participant. The participants and I were well acquainted with each other because, as the TICKIT graduate assistant in the previous 2 years, I had maintained the website, facilitated technology integration workshops, and provided other assistance requested by the program coordinators or participants. Thus, there were moments during the investigation when I took the role of more than an outside observer. For example, when there were inservice technology professional development sessions at one of the schools on a day I was present as an observer, the participant teachers were eager for me to be present partly for data collection purposes and partly to provide help with teacher training. There were other instances during the classroom observations when participant teachers directed students to me when there were technology-related questions that they were unsure how to answer. During the interviews, when there were moments that arose from the discussions that led me to believe that a certain educational resource would be beneficial for participant, I did not hesitate to provide information about the resource so participants would be able to locate them later.

Data Collection Methods

My data collection methods included document analysis, interviews, and classroom observations of 1998–1999 TICKIT participants, non-participating teachers, and school technology support staff. Table 6.1 summarizes these data collection methodologies.

Document Analysis

For the document analysis, I examined school district produced documents including technology plan reports, teacher lesson plans, school newsletters, local

Table 6.1 Data collection procedure summary

Methodology	Sources	Procedure
Document analysis	Materials available at the school district such as technology plan reports, teacher lesson plans, school newsletters, local newspaper articles Data collected from TICKIT 1998–1999 teacher reports and program evaluation	Read all materials and documented any descriptive statistics related to participants and schools
Interviews	Primary participants Secondary participants	Tape recorded semi-structured interviews, then transcribed the interviews for the participants to review
Observations	Observed participants' interactions with technology during classroom teaching, teacher team meetings, and special events at school	Took notes and videotaped the observations
Exit interviews	Primary participants Secondary participants	Presented findings to participants during individual or group interview sessions

newspaper articles, and teacher created reports. I also considered data from the TICKIT 1998–1999 cohort, which consisted of my field notes, participants' project reflection papers, participants' anonymous evaluations of various ongoing workshops, and participants' anonymous evaluations of the program as a whole.

Interviews

Semi-structured interviews were the primary data collection method. The interview questions are presented in Appendices 6.2–6.4. The interviews were tape recorded with participant consent and transcribed. Individual interview transcripts were given to participants who were asked to check for accuracy and inform me of any information they wished to omit. Only one participant extensively edited the transcript before returning it to me. These interview data helped me identify individual teacher activities, activities teachers engaged in small groups, and background information about the school and community culture.

Observations

I conducted observations when participants were engaged in technology curricular integration. These activities included classroom teaching, teacher team meetings, special events hosted at schools, and technology grant planning meetings. I took notes

during the observations using a Palm Pilot and its keyboard accessory and followed the observation notes template I created shown in Appendix 6.5. The observations were videotaped for further analysis. I collected these observation data primarily to gather information on individual teacher activities and typically spent a minimum of a full week in each teacher's classroom. I was able to conduct prolonged classroom observations in all primary participant classrooms except for one teacher who could not find the best time during the year for me to visit her classroom.

Member Checking

Selected segments of all collected data in text format were used as a resource for member checking at individual and group exit interviews. The purpose of the exit interview was to present the research findings to participants and compare my interpretations of the findings with their interpretations. Three primary participants and one secondary participant from the Hillsdale-Berkley School District and one primary participant and one secondary participant from Blackwell participated in the exit interviews.

Data Analysis

I used the constant comparative method described by Strauss (1987) and Strauss and Corbin (1998) for code identification, thematic analysis, and identifying findings. The exact steps I took in this analysis are outlined in Figure 6.1.

Code Identification

Steps 1–4 of Fig. 6.1, describe the processes used to identify an initial set of codes with corresponding definitions. I began open coding, in Step 1, after several iterations of reading the data transcripts. Ideas for possible codes gradually developed during these numerous engagements with the data and I drafted the codes and their definitions on paper. In this process, a code was defined as the minimal thematic unit that represented the prevalent issues across multiple sources and types of data. After I had drafted a set of codes and definitions, I engaged in axial coding as indicated in Step 2. In this process I closely examined the codes and definitions to draw out the relationships among codes and arranged them into families of codes. I looked for ways in which codes were mutually exclusive from one another. If they were not mutually exclusive, I either modified the code and definition or eliminated the code. Once I determined that the list of possible codes had been saturated, I asked a colleague who had not participated in this study to take part in Steps 3 and 4. First, the second coder

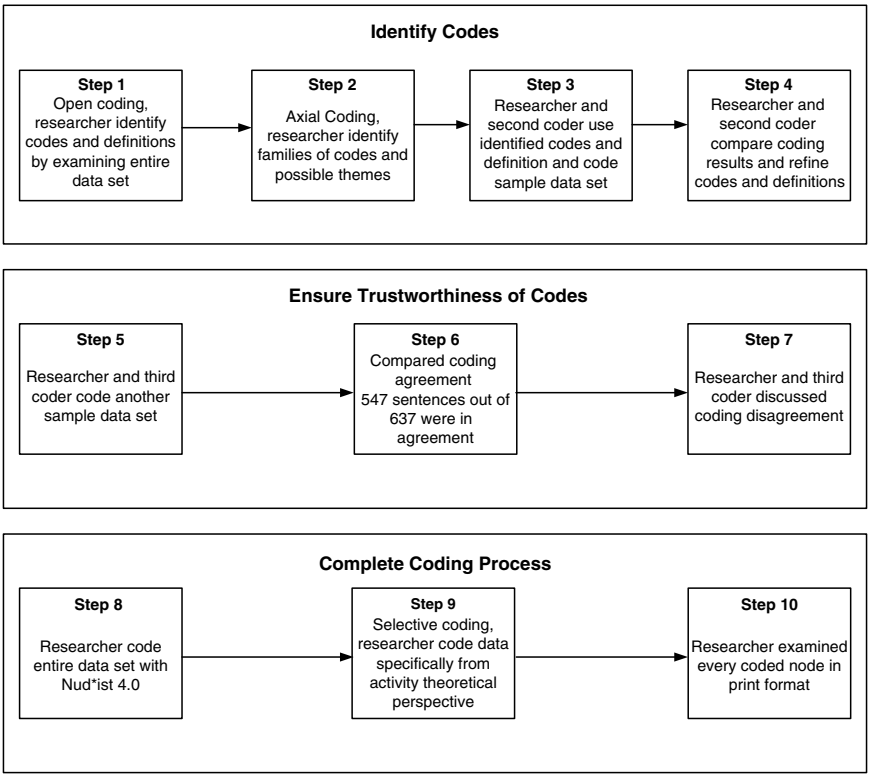


Fig. 6.1 Steps taken for code identification and coding

and I used the codes I had identified and independently coded a sample data set from interview transcripts, observation notes, and documents. During this coding process, both of us modified, added, and deleted codes that did not fit well with the sample data set. This process took three weeks, during which we met on a weekly basis to discuss our progress. After we completed our independent review, we compared the coded data line by line and as a result refined the codes and definitions to assure that they were clear, comprehensive, and mutually exclusive.

Steps 5–7 were taken to ensure that the codes were trustworthy. To begin this process, I selected four interview transcripts that I and another person who had not participated in this study coded line by line using the codes identified in Step 4. The selected interview transcripts were parsed into 637 sentence units that the third coder and I coded. In Step 6 we compared the rate of code agreement and found that we agreed on 547 sentences. In Step 7 we examined each sentence and the assigned codes on which we disagreed and discussed how we interpreted the data, what clarifications were necessary in the codes and definitions that would help us agree, and modified and refined the codes and definitions. The final codes and definitions are included in Appendix 6.6.

Coding

Steps 8 and 10 describe the process I followed to complete the coding. Once I was confident that appropriate measures were taken to ensure trustworthiness of the codes, I coded the entire data set using Nud*ist 4.0, as indicated in Step 8. I created the relational structure of the codes in Nud*ist with the codes and definitions identified in Step 7. In Step 9, I applied selective coding by taking note of the interpersonal object-oriented activities that were in the coded data set, how the coded data represented the components of the activity systems model, and what elements of the coded data represented information about the activity setting. Finally, in Step 10 I engaged in several iterations of reading the printed coded text in preparation for identifying substantiated stories in the coded data and ensuring that no further coding was necessary.

Identifying Activity Systems

After my intense engagement with the data through the code identification and coding activities, I was ready to develop a thick description of participant experiences in narrative format and identify activity systems from these narratives. Figure 6.2 shows the steps I took in this process. In Step 1, I focused my attention on the substantiated stories from the data. In Step 2, I wrote narratives about the two school districts included in the study. While developing these narratives I reminded myself to prepare a thick description of the TICKIT program participants' lived-in experiences to help readers gain an understanding of those experiences. The codes from the data analysis helped put focus in the narrative development process by pointing to information that was relevant and essential to the research question. The preparation of the narratives introduced me to a new stage of analysis in which I was able to re-live participants' experiences from a researcher perspective and find interesting information regarding the two selected school districts.

In Steps 3–5, I began to focus the analysis on identifying participant activities that were essential and relevant to this research. In Step 3, I began to draft activity systems models based on the narratives. While I examined both goal-directed actions and object-oriented activities during the data collection, in the analysis I chose to focus on object-oriented activities because that made more sense based on the research question. I identified units of activities following the historical trends surrounding the interactions among participants, TICKIT, and other school related activities. In Step 4, I compared the series of activity systems I identified to the narratives to check whether there were discrepancies or information in the narratives or the activity systems that needed further attention. In this process, I continually went back and forth between the narratives and the triangle models I had drafted. Drawing the data-based activity systems provided another opportunity

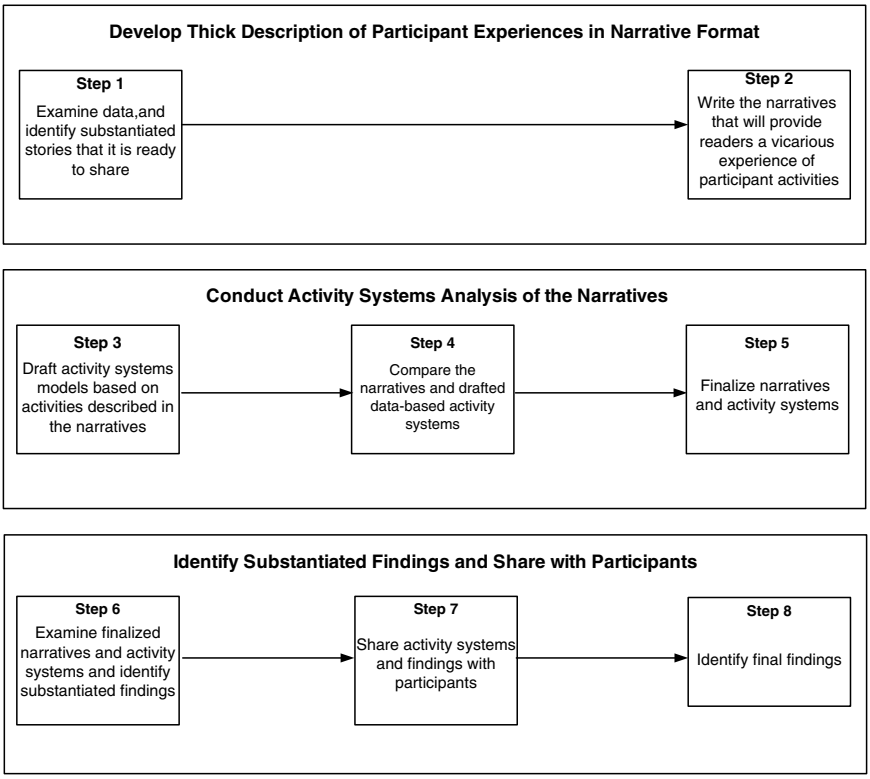


Fig. 6.2 Steps taken to identify narratives and activity systems

to re-live participants' experiences, but this time within a specific framework. In this process, information emerged from the data that I did not find in the previous analytical stages. There were moments where I went back to the narratives and modified them. Identifying activity systems was an iterative process that involved multiple stages of revisions rather than a one-time linear step. In Step 5, I finalized both the narratives and the activity systems analysis and used Microsoft Visio to create an electronic version of the activity systems.

In Steps 6–8, I identified further substantiated findings specifically from a CHAT perspective. In Step 6, I looked for new findings that emerged from the data and the identified activity systems; a list of those findings is included as Appendix 6.7. Please note that the findings that are presented in Appendix 6.7 are earlier versions of the findings that I prepared for participants, thus the wording does not match what is presented later in this chapter. In Step 7, I presented the activity systems models and the list of findings to participants for member checking purposes and asked them for feedback regarding the activity systems analysis as a method for communicating research findings.

Efforts for Maintaining Trustworthiness in this Study

I attempted to maintain trustworthiness in this qualitative CHAT study by prolonged engagement with the research site, persistent observation, triangulation, a rigorous code identification and coding process, and member checking. Prolonged engagement with the research site included 2 years as a member of the professional development facilitator team and another year as a researcher at the two schools. Additionally, I engaged in persistent observation throughout the 3 years with the two schools, but especially in the third year as a researcher.

I implemented several triangulation strategies. I conducted data triangulation by including both primary and secondary participants in the data collection, investigator triangulation by recruiting colleagues to participate in the data analysis, and methodological triangulation by gathering data through interviews, observations, and document analyses. Finally, I engaged in theoretical triangulation by examining the literature on CHAT and teacher professional development, referring to them when I introduced study findings.

I adhered to Schoenfeld's (1992) standards for investigators using novel methodologies to maintain trustworthiness in the activity systems analysis. I addressed Schoenfeld's first criteria Establish the Study Context by introducing literature on works related to this study. In this discussion, I identified new issues that need to be addressed and how my work addressed those issues. In this book I have mentioned this criterion briefly, but there are further extensive discussions in Yamagata-Lynch (2003a, 2003b, 2007). I addressed Schoenfeld's second criterion Provide a Methodological Rationale by describing background information about CHAT in Chap. 2 and by presenting in this chapter the study assumptions from a CHAT perspective that guided methodological decisions. Also in this chapter, I addressed the third criterion Provide a Thorough Description of the Methodology by explaining the steps I took for the constant comparative method and the activity systems analysis. I addressed the fourth criterion Provide a Large body of Data in this chapter, but there is always more data than can be provided. These narratives have been reprinted in this chapter from my past work. I addressed the fifth criterion Provide Methodological Discussion that Identifies the Scope and Limitations of the Novel Method by discussing the strengths and weaknesses of activity systems analysis in this chapter as well as Chaps. 3–5.

Narrative and Activity Systems Analysis of Teacher TICKIT Activities

As indicated earlier in this chapter, the narrative and activity systems analysis that I will present in this section are reprints of my work in three separate peer-reviewed journal articles. Word count limitations of these journals prevented presentation of the data as a single CHAT comparative case study. Each of the three articles highlighted different aspects of my work. Presenting this work in a journal article

format as a comparative study would have required eliminating much of the thick description, and that would have hurt the integrity and trustworthiness of the study report. In Yamagata-Lynch (2003a), I presented results of a qualitative comparative case study but did not present the activity systems analysis results. In Yamagata-Lynch (2003b), I presented the activity systems analysis results based on data from the Hillsdale-Berkley School District. Finally, in Yamagata-Lynch (2007), I used the data from the Blackwell School District to highlight the added value that activity systems analysis brings to design-based research.

When examining the narratives and analysis, please note that I was involved in TICKIT from 1998 to 2001 but the publications are dated 2003 and 2007. During this time, through conference presentations and by receiving valuable feedback from journal editors and reviewers, I developed new understandings of how to communicate results from activity systems analysis. Therefore, there are some differences in how I present the data in the narratives. For example, specifically in my article *Mind, Culture, and Activity* (2003b), I reported tensions in an activity in the form "Tension A vs. Tension B." Since then, however, questions raised by reviewers and editors have made me reconsider how I talk about tensions, and more recently I have come to understand that it made better sense to use non-dualist statements. This change is reflected in the 2007 work published in *The Journal of the Learning Sciences* where I discuss tensions in "Tension A while Tension B" format.

Publisher permissions to reprint my three journal articles are shown here:

Interpersonal Interactions at the Hillsdale-Berkley School District from Yamagata-Lynch (2003b)

At the Hillsdale-Berkley School District, prior to enrolling in TICKIT, there were several self-motivated teachers experimenting with the use of technology in their classrooms. These teachers were interested in using technology, because when the integration was successful, it oftentimes provided a rich learning

environment for students, and students were motivated to learn in this technology rich environment. The school district did not have funds for providing teachers with technology in their classrooms; therefore, the technology enthusiastic teachers applied for small grants that allowed them to provide the hardware and software in their classrooms.

On an everyday basis, Hillsdale-Berkley teachers worked in interdisciplinary teams; however, technology related activities were contained within the boundaries of the classroom. Consequently, teachers did not develop the practice of sharing physical resources such as equipment and software or sharing teaching related ideas and stories. Furthermore, teachers that were not comfortable using technology in their classroom did not consider the enthusiastic teachers' efforts as curriculum development. They perceived activities related to technology curriculum integration to be a hobby-like activity.

The enthusiastic teachers at Hillsdale-Berkley worked with extremely limited technological resources. This led to situations where the computer systems were unstable and teachers did not have adequate access to computer hardware or software for students to use in the classroom. To accommodate this situation, teachers became used to setting up computer stations and assigning students to small groups sharing the computer. Sometimes there were more student groups than available computer stations so student groups took turns and switched from one station to another. Under the above conditions, there were instances where teachers felt they successfully integrated technology in the classroom and instances where they felt that they did not attain the teaching goals they set for their students.

In 1998, the Hillsdale-Berkley School District was awarded the state technology grant. This grant was targeted to improve technology infrastructure and teacher professional development for both the middle and high schools within the district. As the district prepared to purchase new equipment for their middle and high school buildings, they encouraged their technology enthusiastic teachers to participate in TICKIT.

The five teachers that entered TICKIT from Hillsdale-Berkley were given Internet access in their classroom, release time for ongoing TICKIT workshops and the Indiana Computer Educator's (ICE) conference, technical support from the middle school computer applications teacher and the middle school media specialist, and the opportunity to share teaching related ideas and stories with other teachers from both inside and outside their school district. Additionally, new equipment and software were being purchased throughout the year. However, teachers still faced frustrations during their project process. For example, the ongoing upgrades to the school server made it very unstable, and there were occasions when students could not access their work during class and student work was completely lost. Therefore, while teachers at Hillsdale-Berkley participated in TICKIT they faced limitations to their projects due to lack of technology equipment and lack of technology stability at their school.

Being part of TICKIT brought new pressures and a new sense of commitment to participating teachers at the Hillsdale-Berkley School District. These pressures encouraged the teachers to concentrate on completing their program requirements.

Deborah, an eighth grade Math teacher, described in her interview how the pressures from the program were a positive motivation for her to complete her projects. However, in the program evaluation surveys, gathered during the program year, many teachers indicated that they felt overwhelmed and were not sure if the Indiana University staff had a realistic understanding of what type of pressures teachers faced in their daily teaching related activities. Teachers perceived the Indiana University staff to be "out of touch" with realities that teachers faced on a daily basis.

In some cases at the Hillsdale-Berkley School District, participating in TICKIT gave justifications for non-TICKIT participating teachers to acknowledge the TICKIT participants' efforts. By participating in TICKIT, the teachers' efforts in integrating technology into the curriculum and prioritizing them over other teaching responsibilities were well accepted by non-TICKIT teachers. For example, during her interview, Naomi, an eighth grade Language Arts teacher, commented that when she shared the project she completed in TICKIT with the non-TICKIT participating colleagues on her team, the project was acknowledged as an important curriculum unit and not "Naomi's computer project." This acknowledgement by non-TICKIT teachers, that the TICKIT participating teacher projects were part of the curriculum and not just a computer hobby, encouraged a change in attitude of the non-TICKIT teachers, and some became excited to participate in their schools' curriculum technology integration efforts.

At the end of the program, the Hillsdale-Berkley teachers felt that they had gained new technology skills that made them feel more comfortable and confident in using various technologies in their classroom. With their newly gained confidence and technological skills, teachers at the Hillsdale-Berkley School District became eager to incorporate technology into their classroom. Deborah commented on this in the following excerpt from her interview: "being comfortable of using the Internet … being able to create Web pages … did a lot to me in making me feel comfortable…and try to do things for my students …" Furthermore, Alice, a sixth grade Language Arts and Social Studies teacher, felt that her newly gained confidence energized her and made her eager to continue to work on integrating technology in her classrooms. She mentioned during her interview that: "I am always thinking about ways [to integrate technology in the curriculum], what can I do?" However, Hillsdale-Berkley teachers realized that there was not enough equipment for them to use in their day-to-day teaching, especially in the Middle School. Therefore, they decided to apply for grants that would provide the monies for new technologies and professional development opportunities.

At the end of the TICKIT program, there were two new types of communication channels that opened at the Hillsdale-Berkley School District. The first was between the teachers and the Indiana University staff. Naomi mentioned in her interview that the teachers in her building named this phenomenon the "IU-Connection." According to Naomi, this connection refers to feeling comfortable asking the university staff to read drafts of grant application materials, mentioning staff names in grant applications, and also asking if they knew of any grants for which teachers could apply. The second type of communication channel

that opened after TICKIT at the Hillsdale-Berkley School District was among the teachers within the district from different buildings. For example, after being in TICKIT together, Naomi, the eighth grade teacher, and Henry, the third grade teacher, have collaborated on several presentations at reading conferences. During the exit interviews, which were conducted separately, both Naomi and Henry commented that they valued highly these new communication channels across school buildings and grade levels in their district.

With the new sense of confidence, new university connections, and camaraderie shared among teachers, Hillsdale-Berkley teachers became eager and excited to apply for new technology-related grants. As a result, the Hillsdale-Berkley School District was awarded another state grant, which allowed them to purchase a "mobile lab" consisting of two scanners and printers, 10 iMac computers, and 20 iBook notebook computers with wireless Internet connection. When the non-TICKIT teachers at the district witnessed several of the TICKIT projects and found that the school was purchasing more equipment, they became interested in using technology in their own classrooms. Some non-TICKIT teachers even chose to enlist themselves in TICKIT for the 1999–2000 year. The TICKIT 1998–1999 teachers continued to influence their non-TICKIT participating colleagues by taking a leadership role during inservice teacher training sessions and by making themselves available for helping other teachers.

Interpersonal Interactions at the Blackwell School District from Yamagata-Lynch (2007)

Prior to enrolling in TICKIT there were several self-motivated enthusiastic teachers at Blackwell who were experimenting with the use of technology in their classrooms. These teachers were interested in integrating technology into their teaching. They were very motivated to continue their professional development and learn about new teaching methods that would help their students.

These teachers worked on their technology integration projects with extremely limited software and hardware resources. Additionally, they had to juggle competing responsibilities from the school district to meet state mandated curricular standards, use required curriculum packages, and provide remediation programs for students in need. As a result, there was a mixture of successful and unsuccessful teacher technology projects. There were lessons that met curricular goals and that teachers were very satisfied with and there were instances where teachers got stuck trouble shooting the technology and were not able to deliver their intended lesson.

While the self-motivated teachers worked on their technology integration projects, independent of these activities administrators at Blackwell decided to prioritize school-wide technology curriculum integration. The district applied for an Indiana High Tech school grant that was subsequently awarded during the 1998–1999 school year. As a first step to support district technology integration, administrators hired Andrew as the new technology coordinator. They charged Andrew to use the money

from the state grant to develop a strong technology infrastructure in the schools and to provide teachers with a technology professional development program.

During the first year in his position, Andrew focused on providing teachers with sound technology infrastructure. In the future, Andrew had plans for developing an in-house technology professional development program. However, for the first year he identified five teachers who he could trust to become technology leaders for the district and enrolled them in TICKIT. Many of these TICKIT teachers included previously identified self-motivated teachers. Andrew used the opportunities from TICKIT to align what were initially disconnected activities with similar goals initiated separately/independently by individual teachers and the school district.

Andrew made special efforts to meet individual technology needs of TICKIT teachers with the assumption that these teachers would later assist training other teachers in the district. Therefore, TICKIT teachers were explicitly notified that the school district would provide monetary and technical support for them. In return, they were expected to take leadership roles for school-wide technology implementation. The five Blackwell TICKIT teachers were provided with various types of support for completing their projects. This support included (a) Internet access in their classrooms, (b) release time for ongoing TICKIT workshops and the Indiana Computer Educators (ICE), conference (c) technical support from the technology staff, and (d) opportunities to share teaching related ideas and stories with other teachers in TICKIT workshops.

However, teachers still experienced frustrating moments related to technology while participating in TICKIT. For example, Samantha, a first grade teacher, had difficulties implementing her multimedia autobiography project using HyperStudio. She commented in her project reflection paper that as she started her project she quickly learned that understanding the nature of hypermedia environments was too complicated for her students. Additionally, equipment such as digital cameras and scanners, which she needed in the classroom for her project, were not available in her building. Consequently, her access to necessary equipment was limited to short periods during non-school days. These difficulties were exacerbated by the fact that she set the goals of her project too high for herself as a teacher and her first grade students. To Samantha's surprise, when she completed her project she was extremely happy with her students' work.

Many TICKIT participants shared Samantha's above sentiment. During teacher interviews they revealed that by completing TICKIT projects and overcoming frustrating moments with technology it was more likely that they would integrate technology into their future classrooms. Teachers commented that they were now aware of local and university support that is available to them for future technology integration efforts. Teachers further expressed that they were not only comfortable with technology applications, but after TICKIT their confidence was boosted to stay motivated in using technology in their teaching. Additionally, teachers reported that they gained a new sense of respect from their colleagues because the technology integration projects they completed during the school year were within the context of a university professional development program.

Confidence building was important not only for classroom teachers but for the school district as well. Andrew commented that teacher accomplishments from TICKIT resulted in increased school district confidence. Andrew referred to this as "confidence from the top on down." This type of administrative confidence had rippling effects on classroom teachers, because once the Blackwell school board was confident in their teachers they became more willing to spend more money toward technology school reform, and decided to support teachers with more software, hardware, and professional development release time.

Activity Systems Analysis Results of Hillsdale-Berkley District Activities from Yamagata-Lynch (2003b)

At Hillsdale-Berkley there were four distinct activity systems before, during, and after TICKIT that help explain the development of activities related to technology curriculum integration and subsequent teacher activities in the school district. The four activity systems are discussed in chronological order and include (a) before TICKIT teacher activity, (b) during TICKIT teacher activity, (c) immediately after TICKIT teacher activity, and (d) 1 year after TICKIT teacher activity. These activities involved personal and interpersonal planes of analyses and affected one another.

Hillsdale-Berkley Activity System A: Before TICKIT Teacher Activity

Activity System A, in Fig. 6.3, does not represent the activities undertaken by all teachers at the Hillsdale-Berkley School District. Instead, it represents the activity participation of teachers enthusiastic about using technology in their classroom prior to TICKIT; therefore, the subject was a group of self-selected enthusiastic teachers. These teachers at Hillsdale-Berkley were willing to experiment with the technology in the classroom because they believed that technology could be used as a tool to assist student learning. Unfortunately, there were limited resources available to the teachers. These minimal resources, captured in the tool component of Activity System A, included (a) limited hardware/software, (b) unstable technology, and (c) limited funding. The object of the activity system was to use technology in the classroom.

The rules that guided the subject in Activity System A were self-generated goals and daily teaching responsibilities. The self-generated goals pertained to the aspirations that teachers set for how they wanted to use technology in the classroom and what type of results they were anticipating from student performances. The daily teaching responsibilities included their responsibilities within their interdisciplinary teams and the responsibilities they had in their day-to-day practice of teaching.

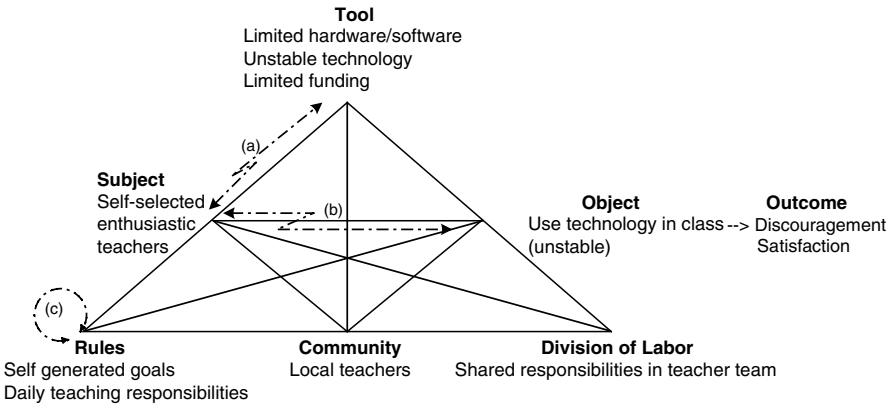


Fig. 6.3 Hillsdale-Berkley Activity System A: before TICKIT teacher activity. Reprinted with permission of Taylor & Francis. Yamagata-Lynch, L. C. (2003b). Using activity theory as an analytic lens for examining technology professional development in schools. *Mind, Culture, and Activity*, *10*(2), 100–119. doi: 10.1207/S1532-7884MCA1002_2

For example, Henry had to incorporate into his third grade classroom a packaged math curriculum that the school district purchased and was testing during the school year.

The community the subject belonged to while carrying out her daily teaching practices was local teachers in the district. However, not all teachers in the district appreciated and respected the subject's innovative efforts in using technology in the classroom. In these situations, although the subject belonged to a team of local teachers, she had to isolate herself from it while attempting to use technology in the classroom. This suggests that the community component of an activity system may not necessarily endorse and support the subject's effort to attain the object. The division of labor within this community was the shared responsibilities among teachers in teams.

The conditions of the components of Activity System A brought forth three tensions. These tensions were (a) sustaining enthusiasm vs. lack of resources, (b) sustaining enthusiasm vs. unsatisfying project, and (c) actualizing self-generated goals vs. competing daily teaching responsibilities. Tension (c) is represented as a circular tension because the two rules of the activity system are conflicting with one another. A circular tension arises as a result of the subject engaging in multiple activities, and the efforts for attaining the object create tensions.

The above tensions forced the teachers to face contradictory situations in their everyday practice of teaching. Such contradictory situations made them juggle multiple responsibilities in their everyday practice while attempting to attain the

object in Activity System A. These conditions provided minimal support for teachers trying to integrate technology into the curriculum.

Consequently, the component with the strongest force of influence that helped the subject attain the object was exerted by the enthusiasm and motivation of the subject. To attain the object in Activity System A, the teachers did not necessarily have to overcome all three tensions, but they needed to confront these tensions and yet sustain their enthusiasm. If the forces from the tensions were greater than the subject's enthusiasm, the activity system would have collapsed and the object would not have been attained. In these situations, the forces from the various components mediate against the subject's effort in attaining the object. Therefore, components in an activity system not only mediate each other for the subject to attain the object but can mediate each other to stop the subject from attaining the object.

The outcome of Activity System A was in some cases discouragement because the attained object was unstable and in other cases was satisfaction because there was smooth integration of technology. The teachers who maintained their enthusiasm for attaining the object took the unstable technology as a learning experience for their professional development. Thus, they kept working for the moments in their classroom when technology integration was successful.

Hillsdale-Berkley Activity System B: During TICKIT Teacher Activity

After being awarded the technology grant and participating in TICKIT, the dynamics of the subsequent activity systems of teachers eager to integrate technology at the Hillsdale-Berkley School District changed. This change is represented in Fig. 6.4 as Activity System B. In Activity System B, the subject was teachers participating in TICKIT in the Hillsdale-Berkley School District. These teachers were now provided with new resources that are itemized in the tool component. These resources were (a) state technology grant; (b) idea sharing with other teachers in TICKIT that may or may not be from their school; (c) shared responsibilities between the individual teacher, school district, and the university staff mandated by the TICKIT program; (d) IU staff; and (e) school-wide Internet connection.

Resources (b)–(d) were identified by Hillsdale-Berkley teachers as benefits of being involved in a professional development program. The school-wide Internet connection was made possible by money from the state grant. This made it possible for teachers and students at Hillsdale-Berkley to access the Web during school hours. Therefore, teachers were able to ask students to conduct Internet research and to access Web pages that the teachers had prepared for educational purposes. These types of activities were not possible in prior years because the school did not have easy Internet access for students. However, during the 1998–1999 school year there was a lack of computers available in the classroom. With the above new resources in the tool component of Activity System B, the teachers attempted to attain the object of completing a tangible project that was successful with students.

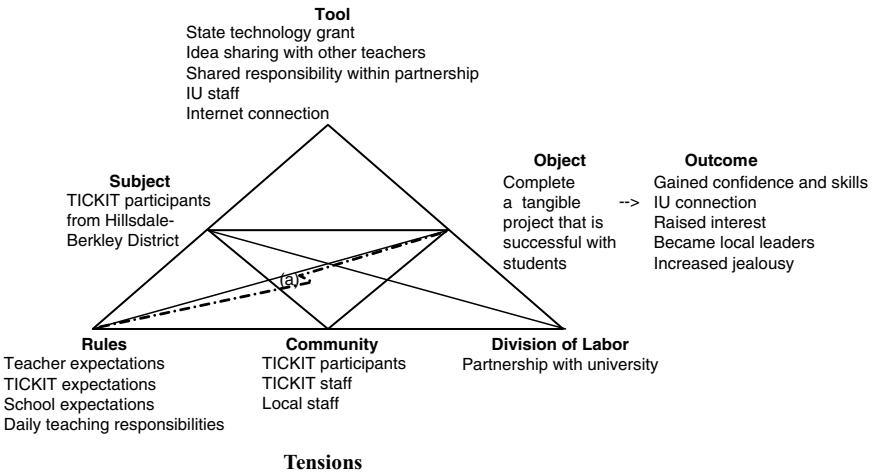


Fig. 6.4 Hillsdale-Berkley Activity System B: during TICKIT teacher activity. Reprinted with permission of Taylor & Francis. Yamagata-Lynch, L. C. (2003b). Using activity theory as an analytic lens for examining technology professional development in schools. *Mind, Culture, and Activity*, *10*(2), 100–119. doi: 10.1207/S1532-7884MCA1002_2

The rules in Activity System B were (a) teacher expectations, (b) TICKIT expectations, (c) school district expectations, and (d) daily teaching responsibilities. The teachers were aware of these rules because they were explicitly stated prior to choosing to participate in TICKIT. Shared responsibilities would not have manifested themselves as a tool in the above activity system without the explicit expectations associated with participation in TICKIT. This is an example of a situation where one component of an activity system, in this case rules, is mediating the content and quality of another component, tool. Therefore, components of an activity system not only mediate the attainment of the object but can also mediate other components.

The community in Activity System B was (a) TICKIT participants including teachers from the same and different school districts, (b) the university staff, and (c) local technology support staff in the district. By becoming a TICKIT participant, the teachers at Hillsdale-Berkley became involved in a new activity system where not all of their local colleagues with whom they worked closely on a daily basis were involved. However, because they were no longer attempting to use technology in the classroom alone, they now had a new group of teachers that were not necessarily working on the same project but shared the common object in the system. Therefore, as in Activity System A, even though teachers who were eager to use technology at the Hillsdale-Berkley School District had to isolate themselves from their local colleagues, in Activity System B they now had a new community of teachers and university staff that was supportive of their curriculum technology integration efforts. The division of labor within this community was shared by the partnership with the university.

Two of the tensions in Activity System A were removed from Activity System B. With the introduction of the new set of resources in the tool component, teachers were successful in integrating technology into the curriculum. The former tensions generated by lack of resources and the unstable object no longer affected the teachers' efforts. However, the rules given to the teachers from the university–school partnership program and their daily teaching responsibilities competed against one another for their attention, energy, and the little extra time that was available in the daily practice of teaching. Therefore, teachers at the Hillsdale-Berkley School District now faced the tension of actualizing expectations for completing the TICKIT project vs. competing responsibilities in their everyday practice of teaching.

The outcomes of Activity System B were (a) gained confidence and skills surrounding technology use in the classroom, (b) built a new connection with university staff – "IU connection," (c) raised interest regarding curriculum technology integration among non-TICKIT participating teachers, (d) became local leader of curriculum technology integration, and, in some cases, (e) increased jealousy within teacher teams.

Hillsdale-Berkley Activity System C: Immediately after TICKIT teacher activity. The following Activity System C (Fig. 6.5) represents the activity that the middle school teachers engaged in after TICKIT. In Activity System C, the subject was TICKIT 1998–1999 teachers and enthusiastic local technology support

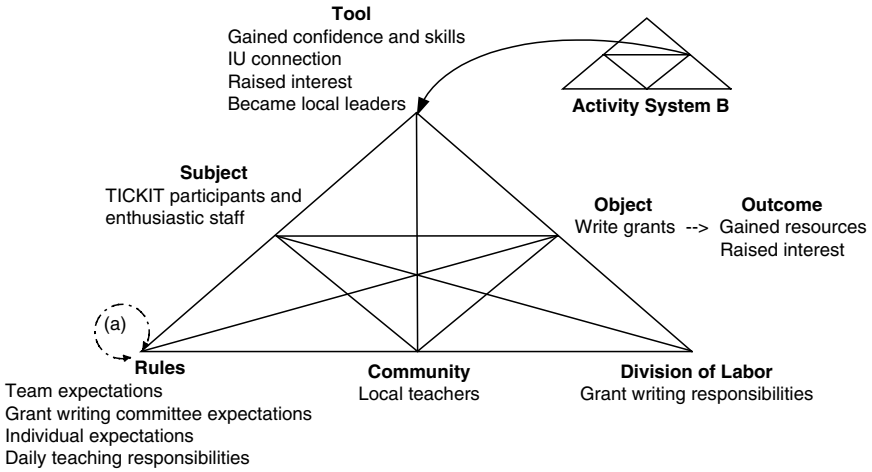


Fig. 6.5 Hillsdale-Berkley Activity System C: immediately after TICKIT teacher activity. Reprinted with permission of Taylor & Francis. Yamagata-Lynch, L. C. (2003b). Using activity theory as an analytic lens for examining technology professional development in schools. *Mind, Culture, and Activity*, *10*(2), 100–119. doi: 10.1207/S1532-7884MCA1002_2

staff members. The tool in this activity system was classified as the outcomes of Activity System B that consisted of gained technology related confidence and skills, IU connection, raised interest among non-TICKIT participating teachers, and TICKIT 1998–1999 participants at Hillsdale-Berkley who became local technology integration leaders. Here there is a nested system of activity, where an outcome of one system that took place prior to a subsequent activity is adopted as a component of the second activity system. The object of this activity was to apply cooperatively for a middle school technology grant in order to purchase more technology equipment.

The rules in this activity were (a) team expectations, (b) grant writing committee expectations, (c) individual teacher expectations, and (d) daily teaching responsibilities. These rules were enforced by the grant writing committee, composed of former TICKIT teachers in the district and school technology support staff members enthusiastic about purchasing more technology hardware.

The community of this activity system was the local teachers. There was a subgroup of teachers within this community that took responsibility for the grant application. These teachers formed the grant writing committee and they were willing to cooperate with others to attain an object that was not required in their everyday practice of teaching. The division of labor in this community was the responsibilities shared among the grant writing committee members.

The tension in Activity System C is similar to Activity System B, actualizing expectations vs. competing daily teaching responsibilities. Due to the fact that grant writing was a task that was not part of their day-to-day teaching responsibilities, it competed for teachers' attention, energy, and time.

The outcome in Activity System C was gained technology resources by purchasing equipment with the grant money awarded to the school. This allowed Hillsdale-Berkley Middle School to purchase their mobile lab. Additionally, the interest of local teachers regarding curriculum technology integration rose because there was new equipment available and there were several model teachers successfully integrating technology in the classroom.

Hillsdale-Berkley Activity System D: One Year After TICKIT Teacher Activity

The monetary resources gained in Activity System C allowed the school to purchase computer hardware stations that were accessible for teachers to wheel into their classroom. This brought new opportunities for non-TICKIT teachers to use technology in their classroom and for the school to host internal inservice training sessions. In Activity System D (Fig. 6.6), 1 year after TICKIT, there were more teachers interested in curriculum technology integration.

In this activity system, the subject was self-selected enthusiastic teachers. This included both former TICKIT participants and non-TICKIT participants. The tool in the activity system was the outcome of Activity System C that consisted of the

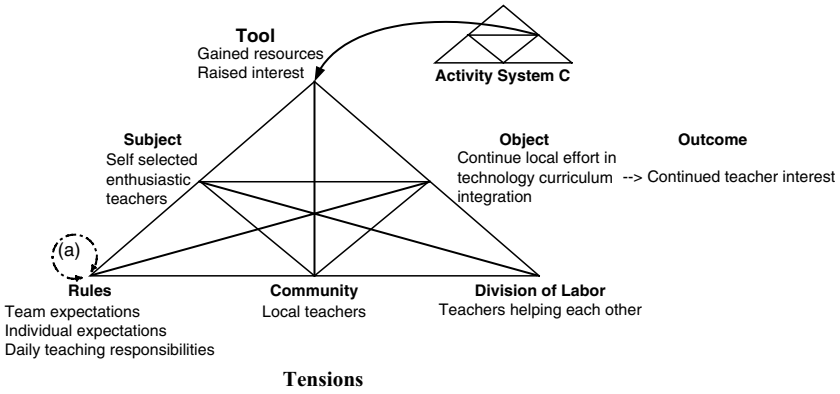


Fig. 6.6 Hillsdale-Berkley Activity System D: 1 year after TICKIT teacher activity. Reprinted with permission of Taylor & Francis. Yamagata-Lynch, L. C. (2003b). Using activity theory as an analytic lens for examining technology professional development in schools. *Mind, Culture, and Activity*, *10*(2), 100–119. doi: 10.1207/S1532-7884MCA1002_2

resources gained through the grant awarded to the school. The object of the activity was to continue local efforts in technology curriculum integration.

The rules of Activity System D were (a) team expectations, (b) individual teacher expectations, and (c) daily teaching responsibilities. Once again, individual teacher-driven goals define the rules of technology curriculum integration. The community was the local teachers interested in integrating technology into the curriculum. This community was no longer limited to teachers participating in TICKIT 1998–1999; in fact, there were other teachers who chose to become early adopters and enrolled in TICKIT 1999–2000 and TICKIT 2000–2001. However, this does not include all teachers. During the early stages of school-wide curriculum technology integration, the late adopters acted as resistors to change.

In Activity System D, the teachers willing to help each other shared the division of labor. The tension in Activity System D was actualizing expectations vs. competing daily teaching responsibilities. The local effort toward technology curriculum integration was done as workload additional to day-to-day teaching. These teachers did not have any release time to design a new unit. Therefore, this created tension between attaining the object and fulfilling other daily teaching responsibilities.

Activity Systems Analysis Results of Blackwell School District Activities from Yamagata-Lynch (2007)

At Blackwell there were five distinct activity systems before, during, and after TICKIT that describe and help explain the development of activities related to technology curriculum integration and how teacher activities, school administrator

activities, school district activities and TICKIT activities interacted with one another. The five activity systems are discussed in chronological order and include (a) before TICKIT and before technology coordinator teacher activity, (b) before TICKIT and before technology coordinator Blackwell School District activity, (c) before TICKIT technology coordinator activity, (d) during TICKIT teacher activity, and (e) after TICKIT Blackwell School District activity. These activities involved all three planes of analyses and affected one another.

Blackwell Activity System A: Before TICKIT and Before Technology Coordinator Teacher Activity

Activity System A in Fig. 6.7 captures the teaching related activity in which a handful of self-motivated teachers at Blackwell individually chose to engage. Here, the subject is a group of self-selected enthusiastic teachers in the individual plane of analysis working to attain the object of integrating technology into the curriculum. These teachers worked alone for the most part, and were willing to experiment with technology because they saw its potential as a motivational tool for students.

Unfortunately, because technology integration was not a shared object at the school building or the school district, there were extremely limited resources and

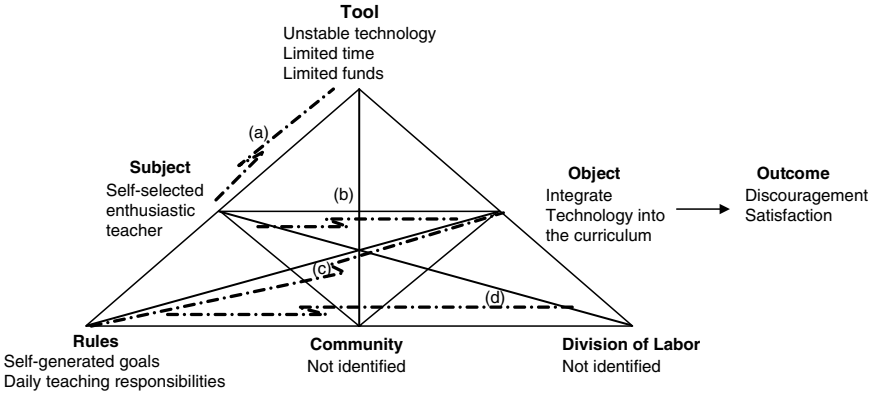


Fig. 6.7 Blackwell Activity System A: before TICKIT and before technology coordinator teacher activity. Reprinted with permission of Taylor & Francis. Yamagata-Lynch, L. C. (2007). Confronting analytical dilemmas for understanding complex human interactions in design-based research from a Cultural-Historical Activity Theory (CHAT) framework. *The Journal of The Learning Sciences, 16*(4), 451–484. doi: 10.1080/10508400701524777

rules that supported and guided these teachers. There were no district level policies or procedures in place regarding technology integration initiatives. The scarce resources are captured in the tool component, which include unstable technology, limited time, and limited funds. The rules included self-generated goals and daily teaching responsibilities. The self-generated goals pertained to the goals that teachers set for themselves regarding how they wanted to use technology in the classroom and what types of results they were anticipating from student performances. The daily teaching responsibilities included individual responsibilities for students in the classroom and responsibilities teachers had to meet the state mandated curriculum.

The community and division of labor affecting teachers in Activity System A did not exist at this time. Teachers worked individually and did not share rules with other teachers in their building or the school district. Therefore, the self-selected teachers did not have a community to share technology related responsibilities.

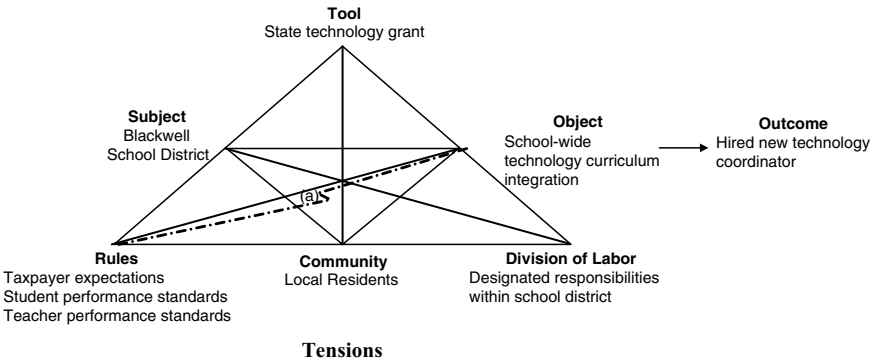
The conditions of this activity brought about four tensions. These tensions include (a) sustaining enthusiasm while working with a lack of resources, (b) sustaining enthusiasm with unstable project results, (c) actualizing self-generated goals and balancing competing responsibilities, and (d) sustaining enthusiasm while working with a lack of shared vision. These tensions created difficult situations in the teachers' everyday activities while attempting to integrate technology into the curriculum. These situations did not help them in their technology integration goals and at times teachers had to give up their goals when other teaching responsibilities took priority.

The outcome associated with Activity System A was a mixed sense of success and failure. Teachers were very satisfied when their technology projects were successful and they were able to meet student learning goals. However, it was discouraging when the technology infrastructure was unreliable. Teachers who maintained their enthusiasm regardless of these failed attempts were able to take these experiences as learning opportunities for their professional development.

Blackwell Activity System B: Before TICKIT and Before Technology Coordinator School District Activity

Activity System B in Fig. 6.8 captures the Blackwell School District as the subject engaged in an activity to attain school-wide technology curriculum integration as the object. The school district is the subject in this activity because it owned the collective activity. The tool that supported this activity was the Indiana High Tech grant. The rules that guided this activity included taxpayer expectations, student performance standards, and teacher performance standards. This activity is situated in the community of local residents in the Blackwell area, and the division of labor is defined by specific roles that school district employees were designated through their job assignments.

In the above activity, the district administrators faced a tension between attaining the object of school-wide technology curriculum integration while meeting multiple



(a) Attaining object while meeting multiple expectations

Fig. 6.8 Blackwell Activity System B: before TICKIT school district activity. Reprinted with permission of Taylor & Francis. Yamagata-Lynch, L. C. (2007). Confronting analytical dilemmas for understanding complex human interactions in design-based research from a Cultural-Historical Activity Theory (CHAT) framework. *The Journal of The Learning Sciences, 16*(4), 451–484. doi: 10.1080/10508400701524777

expectations in the rule component. In order to alleviate this tension the school district hired a new technology coordinator, which was the outcome of this activity. Andrew, the new technology coordinator, was given the responsibility to use the money from the technology grant to prepare a sound technology infrastructure and provide professional development opportunities to teachers. This district activity brought new opportunities and resources for future teacher technology integration activities and alleviated some of the tensions that teachers confronted in Activity System A.

Blackwell Activity System C: Before TICKIT Technology Coordinator Activity

In Activity System C in Fig. 6.9, Andrew is the subject in the individual plane of analysis. His activity is directed by the object of providing sound technology infrastructure and professional development to Blackwell teachers. The tools available to Andrew were district support and the technology grant from Activity System B, and the enthusiastic teachers from Activity System A. However, he did not have access to stable technology equipment nor reliable professional development programs. This limitation of resources created tension in Andrew's activity.

The rules for Andrew's activity were individual expectations, school district expectations, and guidelines from the state on how to spend the grant monies. These rules were shared among the community members that included a handful of enthusiastic teachers and the technology support staff. Additionally, the division of labor was shared among himself, the school district, and his technology support staff.

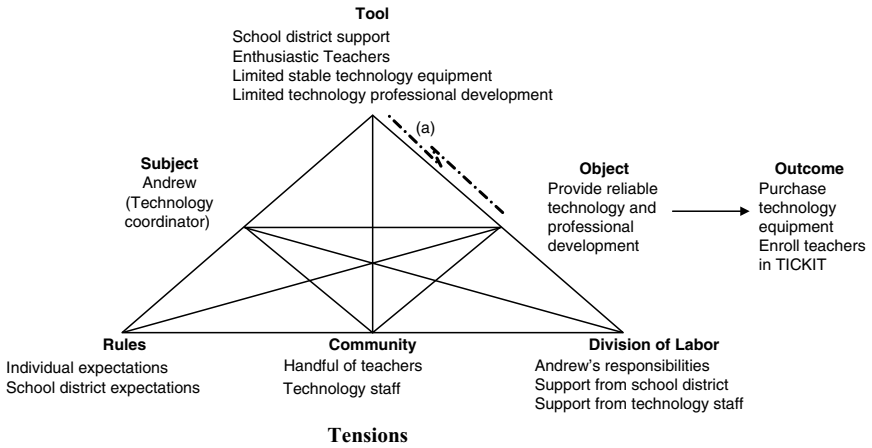
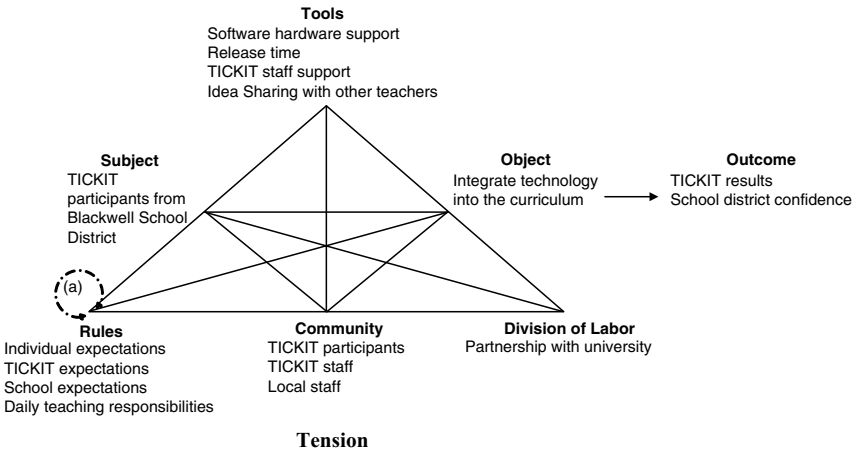


Fig. 6.9 Blackwell Activity System C: before TICKIT technology coordinator activity. Reprinted with permission of Taylor & Francis. Yamagata-Lynch, L. C. (2007). Confronting analytical dilemmas for understanding complex human interactions in design-based research from a Cultural-Historical Activity Theory (CHAT) framework. *The Journal of The Learning Sciences, 16*(4), 451–484. doi: 10.1080/10508400701524777

The outcomes of Andrew's activity included purchasing new and stable technology equipment and enrolling selected teachers in TICKIT. Andrew acted as a broker who aligned the two disconnected activities between the teachers and the school district. This brokerage activity introduced TICKIT as a new tool for teachers in future technology integration activities. He was able to bridge the activities that teachers were participating in as part of Activity System A and the policy decisions that the school district made to support school technology reform in Activity System B.

Blackwell Activity System D: During TICKIT Teacher Activity

In Activity System D in Fig. 6.10, the subject is the TICKIT participants from Blackwell school district. Through TICKIT activities, these teachers worked jointly toward the object of integrating technology into the curriculum. They had access to new resources, rules, and a group of colleagues that changed the dynamic of their technology integration activities. The tools available to them included software and hardware support, release time, TICKIT staff support, and opportunities to share ideas with other TICKIT teachers. Because Andrew acted as a broker who found TICKIT to be a tool that the school district could provide to teachers and teachers could take advantage of during their technology integration activities, teachers found valuable resources that were not available to them before. These resources alleviated



(a) Actualizing expectations while balancing competing responsibilities

Fig. 6.10 Blackwell Activity System D: during TICKIT teacher activity. Reprinted with permission of Taylor & Francis. Yamagata-Lynch, L. C. (2007). Confronting analytical dilemmas for understanding complex human interactions in design-based research from a Cultural-Historical Activity Theory (CHAT) framework. *The Journal of The Learning Sciences, 16*(4), 451–484. doi: 10.1080/10508400701524777

some of the tensions in Activity System A. The tensions that TICKIT and other school district support helped resolve included (a) sustaining enthusiasm while working with lack of resources, (b) sustaining enthusiasm with unstable project results, and (c) sustaining enthusiasm while working with lack of shared vision.

The rules in Activity System D were individual teacher expectations, TICKIT expectations, school district expectations, and daily teaching responsibilities. During the interviews, teachers commented that these rules brought more work and hardship to their already busy work life and there were times that they felt very bitter about all the expectations they had to meet. However, teachers felt that without the demanding rules both from TICKIT and work they would have not been compelled to complete their projects.

The community in Activity System D is TICKIT participants including teachers from the same and different school districts, TICKIT staff, and the local technology support staff at Blackwell. TICKIT teachers from Blackwell now had a community that shared a common goal. The division of labor within this community was shared by the partnership with the university. In this partnership teachers were responsible for completing their technology projects, the school district provided necessary equipment support and TICKIT staff provided technical support.

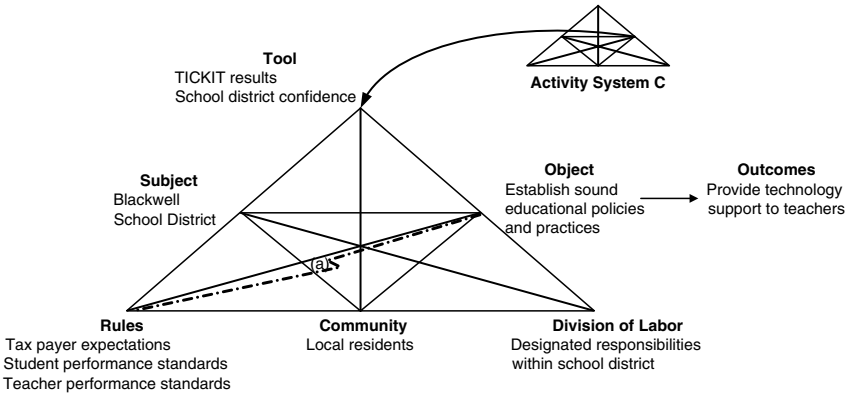
Even though several of the tensions that teachers previously confronted in Activity System A were alleviated in Activity System D, teachers still faced the tension of actualizing expectations for integrating technology into the curriculum while balancing competing responsibilities in their everyday practice. TICKIT expectations and district expectations for daily teaching responsibilities competed against

one another for teachers' attention, energy, and time. Therefore, while TICKIT and district support provided teachers with resources for technology integration, it also complicated teacher activities by introducing new work related expectations. In Fig. 6.10, this phenomenon is represented as a circular tension because the elements within the rule component are bringing a tension to the system.

As an outcome of this activity teachers gained confidence, skills, credibility, and new communication channels for technology-related issues. These findings were reflected in Samantha's experience and other teacher interview data. Confidence and skills helped teachers become local leaders of technology curriculum integration. Consequently, immediately after TICKIT during the summer, all Blackwell TICKIT teachers facilitated at least one technology workshop as an inservice program for other local teachers. This helped move the school district technology reform activities forward.

Blackwell Activity System E: After TICKIT School District Activity

In Activity System E in Fig. 6.11, the Blackwell School District is the subject on the institutional plane of analysis. In this activity, the district is working to establish sound educational policies and practices as the object. The tool for this activity is the TICKIT teacher program results and the school district confidence, both outcomes from Activity System C. The rules that the school district needs to meet in this activity are local taxpayer expectations, student performance standards, and



(a) Attaining object while meeting multiple expectations

Fig. 6.11 Blackwell Activity System E: after TICKIT school district activity. Reprinted with permission of Taylor & Francis. Yamagata-Lynch, L. C. (2007). Confronting analytical dilemmas for understanding complex human interactions in design-based research from a Cultural-Historical Activity Theory (CHAT) framework. *The Journal of The Learning Sciences, 16*(4), 451–484. doi: 10.1080/10508400701524777

teacher performance standards. The community that the school district worked with was the local residents. Finally, the division of labor was designated by individual job assignments.

In the above activity, the school district still faced a tension while attempting to attain sound educational policies and practices and meet multiple expectations. As the outcome of this activity, the school district decided to continue supporting teachers by providing technology equipment and professional development opportunities. Andrew was able to take advantage of this policy decision to continue purchasing and maintaining sound technology infrastructure and to enroll another set of teachers to TICKIT during the 2000–2001 academic year.

Comparative Case Findings

Across the two cases, there were five overarching findings that explained what teacher participants gained from TICKIT and how they continued to use and develop new activities after the program. I will discuss these findings in this section. Please note that the findings presented here are slightly modified version of what was published in Yamagata-Lynch (2003a).

Finding 1: Sharing Ideas Acted as a New Tool that Mediated New Collaborative Initiatives

During interviews, all primary participants and several secondary participants mentioned that sharing ideas with other teachers was a valuable tool introduced to them in TICKIT. In fact, some of the secondary participants, such as media specialists and technology coordinators who initially recruited teachers to enroll in the program, predicted that this was one of the most important experiences that TICKIT would provide for teachers. TICKIT teachers enjoyed the opportunity offered by the program to share ideas and to examine other teachers' curriculum technology integration projects. Teachers in TICKIT shared ideas with other teachers from the same school district, different school districts, different grade levels, and different subject areas. These sharing experiences opened new communication channels for teachers who otherwise would not have been given the opportunity to share ideas with teachers of similar and different backgrounds.

From this experience, TICKIT teachers not only made new colleagues outside their schools, but also built closer relationships with teachers in their own school districts. In some cases, the experiences in TICKIT opened new communication channels during and after the program. This collaboration developed into an ongoing relationship between teachers from the same school who had not worked collaboratively prior to TICKIT. For example, the new relationship stimulated teachers to engage in new workplace activities such as grant writing as reported in the Hillsdale-Berkley School District Activity System C in Fig. 6.5.

During the interviews, I asked teachers if they still communicated with other 1998–1999 TICKIT participants to promote further idea sharing. The primary participants responded that they did communicate with TICKIT teachers from their own school district. However, these communications did not take place on a regular basis with teachers outside of their school district. A couple of these teachers commented that if they had specific information that they wanted from TICKIT participants outside of their building or district, they would not hesitate to send them an e-mail or to start a conversation with them at a social gathering such as a conference. In that sense, TICKIT 1998–1999 participants from the Hillsdale-Berkley and Blackwell school districts expressed a sense of connection with other TICKIT participants.

This finding fits well with Day's (1998) finding that the success of a university–school partnership is positively correlated with the amount of dialogue that teachers have with other teachers in the program. The present study suggests that teachers perceive a university–school partnership to be successful if it encourages them to practice idea sharing in a format that is complementary with their work life. TICKIT encouraged teachers to build formal and informal relationships with teachers from beyond the boundaries of their school district, which Donlevy and Donlevy (1999) identified as one of the many possible positive outcomes of a professional development program.

Finding 2: Program Pressures Introduced New Rules that Mediated New Activities

Both primary and secondary participants reported that during their participation in TICKIT the expectations of the program pressured them to complete their projects. By becoming a participant of the program, and earning six graduate credits at the time of completion, teachers were encouraged to design, develop, implement, and evaluate the two curriculum technology integration projects that they set as their goals at the beginning of the program.

Several teachers commented that while they were in the midst of the program they did not enjoy this pressure. Oftentimes they felt overwhelmed and commiserated with other TICKIT teachers. However, 1 year after their program involvement, teachers reported that this pressure was a positive source of energy for completing their projects. The pressure teachers experienced from being a part of TICKIT made them prioritize technology curriculum integration as one of the important goals for the school year. This is reflected in Hillsdale-Berkley Activity System B in Fig. 6.4 and Blackwell Activity System D in Fig. 6.10. Furthermore, in both school districts the progressive analysis of activity systems shows how the list of items included in the rule component continued to increase and competed with one another for teacher time.

The comments that both primary and secondary participants shared about program pressures reflected how teachers have busy work lives. Teachers have many competing priorities in their everyday work life (Buchmann 1990; Lieberman and

Miller 1999) and there are many innovative teaching ideas that get put on a "back burner" and are never transformed into a curricular unit. In this project, individual teacher goals regarding technology curriculum integration matched the program goals of TICKIT and the overall goals of the two school districts. The shared visions of TICKIT, teachers, and school districts brought pressures for all parties to commit themselves to the program.

Finding 3: New Skills, Confidence, and Connections Acted as New Tools that Mediated New Activities

TICKIT teachers from both school districts recognized that developing technology skills, confidence building, and making connections with university faculty were valuable benefits gained from the program. This is shown in Hillsdale-Berkley Activity System B in Fig. 6.4 and Blackwell Activity System D in Fig. 6.10. Teachers commented during interviews that these benefits helped them continue their professional development after TICKIT and encourage others from their school district to enroll in the program.

In both school districts, TICKIT teachers used the new tools they gained from the program to engage in new activities that brought opportunities to others in the school district. The Hillsdale-Berkley TICKIT teachers used their knowledge about technology, confidence, and connections to write and be awarded a state grant that brought resources to the entire school district as indicated in Fig. 6.5. At Blackwell TICKIT teachers became leaders in their schools, helping other teachers with technology professional development. Additionally, the benefits that the Blackwell School Board saw in their TICKIT teachers acted as a tool for the board to invest in technology infrastructure and further district-wide technology teacher professional development as shown in Fig. 6.11.

This finding is in agreement with past work on collaborative professional development programs. Marx et al. (1998) indicated that access to new information is a potential benefit that teachers find in professional development programs, and Donlevy and Donlevy (1999) reported connections that teachers make with the university staff as another potential benefit. Additionally, the comparative activity systems analyses in this work identified how benefits that individual teachers experienced from TICKIT contributed to activities that affected other teachers and district-wide initiatives.

Finding 4: Tensions Continue to Be a Challenge Between the Rule Component and Object

As indicated in Finding 2, teachers from both school districts faced tensions between attaining their technology curriculum integration goals and meeting daily school responsibilities and participating in TICKIT activities. Many of the teachers

attributed these tensions to the program requirements. However, teachers continued to experience tensions between the rule and object even after the yearlong program. While continuing their own technology curriculum integration activities, Hillsdale-Berkley and Blackwell teachers faced tensions from various pressures, accommodated to competing responsibilities, and attempted to attain their object.

On a daily basis, teachers have multiple sources of pressures imposed on them from their state and district offices. The pressures that participants revealed during interviews included state-mandated student remediation programs, state mandated curriculum standards, use of curriculum packages that had been purchased by the school district, and meeting individual needs of students. These pressures acted as rules that competed for teacher time during and after the program.

From this study, I learned that interventions that are introduced into the participants' activity setting cannot eliminate all tensions. In some cases, well-intended interventions can introduce new tensions that burden participant activities. At the same time, because tensions can be a source of change that initiates new activities, they do not always act as obstacles. As naive as it may sound, examining the results from this comparative CHAT case analysis was the first time I realized that as a researcher and practitioner I will continue to work with project participants who are facing a multitude of rule-based tensions that I cannot do anything to alleviate. It made me understand that CHAT-based qualitative research is heavily contextualized in the participants' activity setting and there is not much I can do to change the situation. Thus, I cannot make it my job to eliminate tensions that participants face. Instead, I need to help participants find activities where they are able to accommodate to their tensions and successfully attain the object.

Appendix 6.1: Participant Informed Consent Form

Study # ##-###

INDIANA UNIVERSITY – BLOOMINGTON

Informed Consent Form
Project Title: Case Study Research on Teacher Knowledge Diffusion of Technology Curriculum Integration
Page 1 of 3

You are invited to participate in a research study. The purpose of this study, conducted by Lisa C. Yamagata-Lynch from Indiana University, is to examine direct and indirect impact from the 1998–1999 Teacher Institute for Curriculum Knowledge About Integration of Technology (TICKIT). I am interested in assessing if school participation in TICKIT had any long term impact on the following (a) TICKIT participant classroom teaching, (b) non-TICKIT participant classroom teaching, and (c) school-wide changes.

INFORMATION

Participants of this research will be recruited from two different TICKIT 1998–1999 school districts. Three to four TICKIT 1998–1999 teachers, and a total of four to six non-TICKIT teachers, two to three computer coordinators and two to three school administrators will be asked to participate in this study from each district. Audio taped interviews with all participants will be conducted. These interviews will take between 40 and 60 min. A total of one to three interviews with the TICKIT 1998–1999 participants will be conducted, and for the rest of the participants, one to three interviews will be conducted. After each interview the investigator will provide participants with transcripts to review for accuracy and for requesting any omission of specific information from the data set. With the participants' permission, the investigator will then analyze data from the "Program Evaluation of the Teacher Institute for Curriculum Knowledge About Integration of Technology (TICKIT)" Protocol #98-2532 conducted during the 1998–1999 school year by Dr. A and Dr. B at Indiana University. The data set from the above research include online conferencing on the World Wide Web, responses to surveys and open ended questions regarding computer use and attitudes about integrating technology in classrooms, and interview data.

Additionally, the investigator will conduct document analysis of materials available such as school technology plan reports, participant lesson plans, school

newsletters, and local newspapers. Observations will be conducted in the classrooms of 1998–1999 TICKIT teachers for 3 weeks per classroom. During these observations, the investigator will sit in the back of the room taking notes. These notes will be provided to the participants to review. With the consent of the participant, selected observation events will be videotaped. These videotapes will be used in a stimulated recall interview where the participants will be asked to provide the investigator explanations and reflections to specific events that occur in the videotapes. These sessions may last from 30 to 40 min. All write ups, audiotapes, and videotapes will be stored over the next 3 years. Dr. A and Dr. B will have access to data collected in this study for future research and evaluation regarding TICKIT. The data that will be shared with Dr. A and Dr. B will have identifiers of each participants of the current research.

INDIANA UNIVERSITY – BLOOMINGTON

Informed Consent Form
Project Title: Case Study Research on Teacher Knowledge Diffusion of Technology Curriculum Integration

RISKS (None foreseen)

BENEFITS

This study will bring light to the area of research in Community of Practice, and identify if a yearlong professional development program for a selected number of teachers in a school district has any impact on the whole school system.

CONFIDENTIALITY

Please understand that any information obtained about you as a result of your participating in this research will be kept as confidential as legally possible. For research purposes all interview transcripts, observation field notes, and documents will be coded to protect anonymity. Participants of this research will be given a pseudonym and data analysis, discussion, and presentation will be conducted in these pseudonyms. All information collected as a result of this research will be restricted to the investigator of this research and the two faculty members who are program coordinators of TICKIT at Indiana University. In addition, if the result of this research is presented at a professional meeting or results in a journal publication, no information by which you can be identified will be included. However, because of the nature of this research and there are not many participants involved even if pseudonyms are used it might be possible for individuals to be identified. The audiotapes, videotapes, and code lists will be destroyed on 5/1/04.

CONTACT

If you have questions at any time about the study or the procedures, you may contact the investigator, Lisa C. Yamagata-Lynch, at ≤street address was inserted here≥, Bloomington, IN 47408, or 812-≤phone number was inserted here≥. If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have not been honored during the course of this

project, you may contact the office for the Human Subjects Committee, Bryan Hall 110, Indiana University, Bloomington, IN 47405, 812/855-3067, or by e-mail at iub_hsc@indiana.edu.

PARTICIPATION

Your participation in this study is voluntary; you may refuse to participate without penalty. If you decide to participate, you may withdraw from the study at any time without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before data collection is completed your data will be returned to you or destroyed.

INDIANA UNIVERSITY – BLOOMINGTON

Informed Consent Form
Project Title: Case Study Research on Teacher Knowledge Diffusion of Technology Curriculum Integration
Page 3 of 3

CONSENT

I have read this form and received a copy of it. I have had all my questions answered to my satisfaction. I agree to take part in this study.

Subject'ssignature_____ Date_____

Investigator's signature_____ Date _____

Consent form date *<Insert Date>*

Appendix 6.2: Primary Participant Teacher Interview Protocol

Time:	Date:	Place:
Interviewer:	Interviewee:	Tape Identifier:

1. Please summarize your teaching experience thus far. How long have you been teaching? Have you worked at other schools?
2. What type of classroom atmosphere do you promote in your classroom? What type of teaching style do you prefer?
3. What type of relationship do you have with your students?
4. Reflecting on the past year, have you noticed any changes in your teaching as a result of participating in TICKIT?
5. If yes, what were they and how did TICKIT affect this change?
6. What were some of the most valuable experiences from TICKIT that you think made a change to your teaching?
7. How did your students react to your TICKIT technology integration project? What were some of your student comments?
8. Have you used the technology integration projects you developed in TICKIT 1998–1999 during this school year?
9. Do you plan to use the technology integration projects you developed in TICKIT 1998–1999 next school year?
10. Have you expanded your technology integration projects from TICKIT 1998–1999?
11. Do you think that your participation in TICKIT has made any impact on your non-TICKIT colleagues at your school? If yes, what type of impact do you think you made?
12. Do you communicate with any of the TICKIT teachers from last year within or outside of your school? If yes, what type of interactions have you had?
13. Do you communicate with the current TICKIT 1999–2000 Teachers? If yes, what type of interactions have you had?
14. How would you describe the social atmosphere of your school?
15. Do you regularly collaborate with your colleagues?
16. What do your students do after they graduate from your school?
17. If you were to estimate the percentage of teachers that use technology in their classroom at your school, what would it be?
18. Do you have anybody in mind that you think I ought to speak to for my research?
19. Would you recommend any school events that you think I ought to observe?
20. Is there anything that I should know that I have not asked you?

Thank you very much for your participation.

Appendix 6.3: Secondary Participant Teacher Interview Protocol

Time:	Date:	Place:
Interviewer:	Interviewee:	Tape Identifier:

1. Please summarize your teaching experience thus far. How long have you been teaching? Have you worked at other schools?
2. What type of classroom atmosphere do you promote in your classroom? What type of teaching style do prefer?
3. What type of relationship do you have with your students?
4. Have you observed any changes to the teaching of teachers that participated in TICKIT 1998–1999?
5. Can you identify any influence from the TICKIT 1998–1999 participants on your own teaching?
6. How would you describe the social atmosphere of your school?
7. Do you regularly collaborate with your colleagues?
8. What do your students do after they graduate from your school?
9. If you were to estimate the percentage of teachers that use technology in their classroom at your school, what would it be?
10. Do you have anybody in mind that you think I ought to speak to for my research?
11. Would you recommend any school events that you think I ought to observe?
12. Is there anything that I should know that I have not asked you?

Thank you very much for your participation.

Appendix 6.4: Secondary Participant Non-teacher Interview Protocol

Time:	Date:	Place:
Interviewer:	Interviewee:	Tape Identifier:

1. Please summarize your role within the school corporation. What do you do every day?
2. What types of relationship do you have with teachers in your school corporation?
3. Why did you think that TICKIT would be a good project for your teachers to participate?
4. Have you observed any changes to the teaching of teachers that participated in TICKIT 1998–1999?
5. Have you observed any influence of TICKIT 1998–1999 teachers on the non-TICKIT participating teachers?
6. Have you observed any school-wide changes that you can attribute to TICKIT?
7. How would you describe the social atmosphere of your school?
8. What do your students do after they graduate from your school?
9. If you were to estimate the percentage of teachers that use technology in their classroom at your school, what would it be?
10. How do your teachers use technology in their classroom?
11. Do you have anybody in mind that you think I ought to speak to for my research?
12. Would you recommend any school events that you think I ought to observe?
13. Is there anything that I should know that I have not asked you?

Thank you very much for your participation.

Appendix 6.5: Observation Notes Template

Observation Event: Time:

Date: Place:

Time	Descriptive notes	Reflective notes

Summary

Important Themes for Next Observation and Future Interviews

Appendix 6.6: Finalized Codes and Definition

Code	Definition
Meta-Code: Teacher Information	
1 Teaching experience	General information regarding a teacher's experiences
2 Teaching philosophy	Information that reflects the teaching philosophy of the teacher
3 Teacher reflection	Information that reveals that the teacher is reflecting on his/her teaching
4 Background information	Information regarding the background information of students and the school
Meta-Code School Information	
5 Existing teamwork	The teamwork that already exists at the school site
6 Lack of technology	The lack of technology hardware and software at the school site
Meta-Code: Curriculum Technology Integration Project Related	
7 Project type	The type of project, include the information regarding the technology used in the project that was completed by a teacher while participating in TICKIT
8 Project description	The details of the completed project while participating in TICKIT
9 Project goals	The student learning goals of the project
10 Project resources	Elements that TICKIT participants refer to as resources for completing their project
11 Project difficulties	Difficulties that the TICKIT participants faced when completing their project
12 Expanding existing project	Information that reveals that the TICKIT participant decided to expand an already existing lesson plan for his/her project
13 Teacher evaluation of project	The teacher is evaluating his/her own curriculum technology integration project
14 Student reactions	By implementing the technology curriculum integration lesson in class, students reacted in one way or another
15 Student evaluation	Student suggestions and comments regarding the project
16 Student influence	Any information that indicates that TICKIT participants' students influenced the direction of the project
17 Parent reactions	Parent suggestions and comments regarding the project
18 Non-TICKIT teacher reactions	Non-TICKIT teacher suggestions and comments regarding the project
Meta-Code: Professional Development Outcome Related	
19 External pressure	The structure of the professional development set concrete expectations for teachers on what they had to accomplish by the end of the program
20 Idea sharing	Structure of the professional development program enabled teachers to share ideas with one another through activities such as critical friends, presentations at workshops, and participating in the ICE conference

(continued)

(continued)

21	Gained confidence	By completing the professional development experience teachers became more confident and a daredevil in terms of using technology in their classroom
22	Gained skills	By completing the professional development experience teachers gained various technology skills for integrating in their curriculum (e.g. integrating the Internet for research, using PowerPoint as a writing and presentation tool, etc.)
23	Gained respect	By completing the professional development experience teachers gained respect from administrators and colleagues. The teachers' technology project became a more of an "official curriculum" rather than a hobby
24	Gained realistic goals	By completing the project, the teacher gained a sense of what are realistic and non-realistic goal for a curriculum technology integration project
25	Attainment of tangible project	By completing the professional development experience teachers accomplished a tangible technology curriculum integration project that they were able to share with other teachers in their school
26	Project recycling	After completing the professional development program, the teachers continued to redesign and use the technology curriculum development project in their classroom
27	Became local expert	After completing the professional development program, participants became local experts on technology curriculum integration
28	University connections	Through the partnership with the University the teachers gained internal connections with faculty at the University (IU-Connection)
29	Increased communication	After participating in the professional development program, teachers frequently discussed about technology use in the curriculum
30	Increased eagerness	After participating in the professional development program the teacher became more eager to use technology in the classroom
School Related Outcomes		
31	Raised interest	Teachers that were not involved in the professional development program became interested in using technology in their classrooms
32	Helping others	The participants of the professional development program became involved in school wide activities such as: Web clubs, within school professional development, grant writing, helping other teachers
33	Gained more technology	After the professional development program the school gained grant money to purchase more technology
34	Increased use of technology	After the professional development program there were increase use of technology at the schools. There were more teachers using labs, Internet, and booking mobile computers

(continued)

School Related Outcomes (continued)	
35 Increased communication regarding technology	After the professional development program there has been more communication regarding technology between teachers at the school
36 Gained non-TICKIT teacher involvement	Teachers that were not involved in the professional development program became involved in technology curriculum integration
Meta-Code: Classroom Related Student Behaviors	
37 Problematic student behaviors	The students display a problematic behavior during class
38 Student enthusiasm	The students are enthusiastic about the classroom activities
39 Student initiated task checking	The student asks the teacher to verify the student is on task
40 Student independent work	The student is working independently during class hours
41 Student helping others	The student is helping others both teachers and students
42 Student work arrangement	The physical workspace situation that the students are in while working on classroom tasks
Meta-Code: Classroom Related Teacher Behaviors	
43 General announcement/lecture	The teacher is conducting a general announcement/ lecture to the whole class
44 Teacher demonstration	The teacher is conducting a demonstration to the class/ students
45 Just in time lecture	The teacher is conducting a lecture based on the needs of the students
46 Encourage student exploration	The teacher is encouraging student exploration
47 On task checking	The teacher asking the students what they are doing, to check if they are on task in their individual work during class
48 Interdisciplinary activity	The teacher is involving her students to activities not only of one subject area, but that involves interdisciplinary areas
49 Unexpected non-technology interruption	The class is interrupted due to non-technology related reasons
50 Unexpected technology interruption	The class is interrupted due to technology related reasons
51 Task clarifications	The teacher is clarifying the task that students are undertaking
52 Teacher team work	The teacher is involved in working with other teachers in the school as a team
53 Technology advice	The teacher is giving technology related advice to her students
54 Fixing technology problems	The teacher is fixing a technology problem that occurred
55 Off task behavior correction	The teacher is correcting the off task behavior demonstrated by students

Appendix 6.7: Study Findings Presented to Participants and Exit Interview Questions

Finding 1

Teachers that participated in TICKIT enjoyed sharing ideas and their projects with other teachers participating in TICKIT.

Finding 2

The shared responsibilities of being a member of a university school partnership encouraged teachers to complete their curriculum technology integration projects.

Finding 3

TICKIT brought opportunities to gain technology skills, confidence, and new connections with the partner university for teachers that participated in TICKIT.

Finding 4

Teachers that participated in TICKIT felt they successfully integrated technology in the curriculum, to motivate and encourage students to gain content-based learning goals.

Finding 5

Teachers that participated in TICKIT became local leaders of technology curriculum integration.

Questions to Participants Regarding Activity Systems

Do you have any comments on this picture?

Do you see any components that are misrepresented in picture?

If you were to add something into this picture, what would you like to add?

Probe if necessary: I can see some elements missing such as ISTEP, parental concerns, student parole issues…..

Ask When Finished Showing Last Activity System

Do you see that you can use this in any way for your own professional development?

Chapter 7
Concluding Remarks

Keywords Tensions in Cultural Historical Activity Theory (CHAT) • Activity systems analysis future development areas

I began this book with the intent to introduce Cultural Historical Activity Theory (CHAT) and activity systems analysis to researchers and practitioners interested in studying complex learning environments. Following this intent in Chap. 1, I attempted to highlight the benefits that activity systems analysis brings to the study of complex learning environments. I then presented in Chap. 2 background information on Vygotsky's work and the work of post-Vygotskian CHAT scholars. I addressed criticisms against activity systems analysis while discussing the challenges related to conducting investigations from a nondualist perspective in Chap. 3. In Chap. 4, I presented seven examples of studies that relied on activity systems analysis to examine complex learning environments. Chapter 5 provided an overview of general qualitative research methodologies that are critical for conducting a sound study using activity systems analysis. When appropriate, in Chap. 5 I referred to examples included in Chap. 4. Finally in Chap. 6, I presented one of my own in-depth CHAT-based comparative case studies and shared background information, data collection methods and instruments, sample data sets, and the findings for readers to examine the research design, data collection, and data analysis processes. Much of what I presented in Chap. 6 addressed the methodological issues introduced in Chap. 5. In this chapter, I will summarize the main ideas introduced in this book and provide suggestions for researchers and practitioners regarding where to go from here with their own investigations using activity systems analysis.

Summary

CHAT is the foundation of activity systems analysis and it has a rich history, owing much of its original work to L.S. Vygotsky during the 1920s and 1930s and post-Vygotskian scholars who worked with A.N. Leontiev and A.R. Luria. The founda-

L.C. Yamagata-Lynch, *Activity Systems Analysis Methods: Understanding Complex Learning Environments*, DOI 10.1007/978-1-4419-6321-5_7,

tion of activity systems analysis is mediated action that Vygotksy conceptualized as an alternative to the Associationist perspective, which explained human development as a progressive experience of stimulus and response associations. Mediated action assumes that the interactions between the organism and the environment are inseparable – that individuals, or subjects, find new meaning about their world by interacting with artifacts, tools, and social others in their environment. This interaction helps the subjects attain the object or the goal, motive, or reason for participating in activities. The results of these activities influence the subjects' understanding of the world in which they are situated.

Activity systems analysis extends mediated action by identifying and including sociocultural aspects of human activity as critical elements of the units of analysis. This allows investigators to examine human activity within its complex environment. The sociocultural elements in activity systems analysis are subject, tool, object, rule, community, and division of labor. Researchers and practitioners need to be versed in communicating these fundamental ideas of their work to demonstrate a strong understanding of CHAT and to provide background information that will help their audience interpret their work.

Most North American or English-speaking scholars work with translated texts of the original Russian CHAT publications because they are not fluent in the language. This has resulted in multiple English-language versions of original works that have, in some cases, spawned discussions related to the accuracy of the translations. If researchers and practitioners cannot read the original Russian texts, there are times when it is difficult to determine which English texts are reliable. English-speaking investigators need to conduct a thorough reading of the translated texts and clearly identify how their interpretations of the theoretical concepts were influenced by specific texts.

Activity systems analysis brings several added values to researchers and practitioners. First, it provides a manageable bounded framework to examine and describe how human activity and the activity setting co-evolve over time. Second, by using activity systems analysis, investigators can identify systemic issues that cut across multiple activities within the participants' context. Third, this framework allows investigators to examine the systemic contradictions that introduce tensions into participant activities and overwhelm the participants' abilities to attain the object. Fourth, investigators can identify solutions that will help manage prohibitive tensions. Fifth, investigators can monitor how new solutions within an activity can affect subsequent activities and the activity setting. Sixth, by monitoring these interactions, investigators can evaluate the effectiveness of solutions they introduce into the participants' activity setting. Finally, seventh, when investigators choose to take a collaborative approach to work with participants to find solutions to existing problems, they can use activity systems analysis as a practical problem-solving and communication tool.

There are several valuable critical reviews of activity theory and activity systems analysis. The criticisms relate to the comprehensiveness of activity theory as a theoretical framework, the complexities involved in understanding and conducting activity systems analysis, and the problems associated with using human activity as

a unit of analysis in research. Examining critical reviews of activity theory and activity systems analysis can help researchers and practitioners to develop further understanding of this theory and the methodology. Thus, researchers and practitioners need to be aware of these reviews and address them in their own work.

Activity systems analysis has been already applied to various research and practice studies including business management, educational reform, educational technology, Human–Computer Interaction (HCI), Human Performance Technology (HPT), organizational behavior, and program evaluation. In many cases, investigators have used activity systems analysis for different purposes and approaches. Some of these studies include works that help (a) understand developmental work research (DWR), (b) describe real-world learning situations, (c) design human–computer interaction systems, and (d) plan solutions to complicated work-based problems. Investigators who examine these studies may not find a consistent approach to engaging in activity systems analysis; however, they will find that in many cases researchers and practitioners rely on activity systems analysis to identify systemic contradictions and how those contradictions affect participants' daily activities by introducing tensions.

To take advantage of the added values that activity systems analysis brings to research and practice, investigators need to follow sound research methods to maintain the trustworthiness of their work. Investigators can arrive at meaningful and trustworthy conclusions only when they have a comprehensive data set that represents authentic participant experiences. The results from an activity theory research cannot be high quality if investigators do not engage in trustworthy research. Therefore, it is critical that researchers and practitioners are well versed in research methods as much as they are versed in the CHAT.

Where to Go from Here?

It is my hope the information provided in this book will assist researchers and practitioners as they continue their theoretical investigations about CHAT while they design and develop studies about complex human learning environments using activity systems analysis. I have discussed several fundamental issues related to CHAT and activity systems analysis that need to be addressed when investigators work with this framework and methodology. These issues can be represented as tensions of their own that affect the investigators ability to engage in their work. These tensions include:

1. Develop a strong understanding about CHAT while reconciling conflicts in the interpretations of theoretical concepts due to translation problems.
2. Be able to describe CHAT and study details in a manner that is meaningful to an audience while providing enough information to maintain the integrity of the work.
3. Maintain a rich understanding of the qualitative data while committing to a representation of the data using the triangle models.

4. Maintain trustworthiness of the qualitative study at the same time that they maintain trustworthiness of the activity systems analysis.
5. Develop conclusions that address CHAT interests from both theoretical and practical perspectives while addressing the context of the research problem.

Many of the issues related to these tensions have already been discussed in this book; however, I would like to emphasize that by directly addressing these tensions and sharing how they do so, researchers and practitioners will be able to better communicate the value of their work to others. It will help researchers and practitioners to identify the purpose of their work and the audience before deciding how to manage these five tensions. How investigators choose to manage tensions may be different depending on the person and the nature of the work. Investigators need to address the tensions, but depending on the purpose of the work and the audience, it will be inappropriate to report on all of them.

In many cases, study reports in the form of journal articles, presentations, white papers, and project reports are severely abbreviated versions of what authors and presenters can share about their study. The constraints of space and time limitations make it necessary for researchers and practitioners to assure that the information they include in their reports is critical for maintaining the integrity of the work. At the same time, this restriction on space and time may be a blessing; reading about and listening to reports of complex human learning environments can be overwhelming. Thus, these restrictions are an excellent reason for investigators to provide manageable reports of their work that help their audiences find meaning that is relevant to their own research.

For future fruitful developments in activity systems analysis as a robust qualitative research methodology of complex human learning environments there needs to be wide application of this method. These investigations can be related to various organizational contexts including education, nonprofit, government, and business. Investigations can include topics related to human learning, instructional design, human performance issues, and program evaluation. These investigations need to be shared; more discussion regarding methodological issues will help investigators identify how to use activity systems analysis in various situations. Finally, there needs to be further efforts by researchers and practitioners to emphasize the original intent of this methodology as a tool for both research and practice.

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Glossary

Activity setting An activity setting is a bounded system related to the social environment in which object-oriented activities and goal-directed actions are anchored with other related activities with similar objects (Gallimore and Tharp 1990). It is the setting that provides the context in which activities take place (Tharp and Gallimore 1988). Activity settings are an inseparable component of human cognitive action (Rogoff 1990) because they influence the types of activities subjects will potentially encounter.

Activity systems analysis Activity systems analysis is one method discussed in Engeström (1987, 1993) and Cole and Engeström (1993) for analyzing human interactions with CHAT by identifying human activity as the unit of analysis. It is based on Vygotsky's concept of mediated action and captures human activity in a triangle model that includes the subject, tool, object, rule, community, and division of labor.

Artifact Artifacts are physical objects within an activity setting that can take a role in a subject's activity.

Axial coding Axial coding is one of the steps in the constant comparative method that involves an intensive analysis of the categories of codes that were previously identified during open coding.

Associationism Associationism is a popular philosophical perspective that became the foundation of behaviorism by promoting the belief that mental activities can be described by associations of one state with another.

Case study research Case study research is an approach within qualitative research in which an investigator attempts to achieve a deep understanding of a single case and its particularities.

Chain of evidence Chain of evidence is a qualitative research tool to maintain trustworthiness that requires investigators to provide the information necessary for an external observer/reader to be able to trace the investigators' steps from the research question to the conclusions.

Complex learning environment Complex learning environments are natural settings in which multiple individuals share activities within a single or multi-organizational context.

Constant comparative method The constant comparative method is a systematic qualitative research analysis method introduced by Glaser and Strauss (1967) as part of the grounded theory development. Numerous publications about this method include Strauss (1987), Strauss and Corbin (1998), Glaser (1992), and Corbin and Strauss (2008). For this analysis method, investigators engage in intense examination and reexamination of their data set to identify salient codes and themes while comparing one source with another to find similarities and differences. There are three code identification processes involved including open coding, axial coding, and selective coding.

Cultural Historical Activity Theory (CHAT) CHAT is a theoretical perspective within the field of psychology that originated in L. S. Vygotsky's work in Russia during the mid 1920s to mid 1930s and attracted the interest of a growing number of scholars. This psychological perspective takes into account the inseparable relationship between the organism and the environment in human development. CHAT scholars examine human activity as the unit of analysis rather than examining a series of stimulus and response associations. They examine the interactions shared among human consciousness, observable behavior, and cultural setting through mediated action.

Cultural tools Cultural tools are artifacts that over time take a critical role in an activity and evolve to a critical community resource for individuals to participate in activities in their activity setting.

Community The community in activity systems analysis is the social group that subjects belong to while engaged in an activity.

Division of labor The division of labor in activity systems analysis determines how tasks are shared among a community within the activity setting.

Developmental Work Research (DWR) DWR is an investigative method that makes use of activity theory to identify systemic contradictions that bring tensions to participant activities and then implement organizational change.

Document analysis Document analysis is a qualitative research data collection method in which the investigator examines documents and artifacts that participants produced or are available at the research site. Investigators often gain new contextual information that explains and verifies what they learn from interviews and observations.

First generation activity theory First generation activity theory is Vygotsky's method for examining human activity through mediated action.

Goal-directed action Goal-directed action is a temporary, individually focused set of actions that subjects take as a step in their participation in an object-oriented activity.

Human activity Human activity is the unit of analysis in CHAT research that examines human consciousness, observable behavior, and cultural setting through mediated action.

Internalization Internalization is a theoretical concept that Vygotsky used to explain how individuals processed what they learned through mediated action in the development of individual consciousness.

Interview Interviews are a qualitative research data collection method in which the investigator talks with participants. It can provide information about the natural setting in the participants own words and can be structured, semi-structured, or open-ended.

Kharkovites Kharkovites were a group of Russian psychologists including A. R. Luria, A. N. Leontiev, and others who formed the Kharkov School of Developmental Psychology in the early 1930s to continue Vygotsky's work through the study of activity.

Mediated action Mediated action is a theoretical concept that Vygotsky used to explain human activity through a semiotic process. It is a process where individuals interact with artifacts, tools, and social others in their environment and find new meanings about their world.

Mediated action triangle The mediated action triangle is Vygotsky's basic model that includes the *subject, mediating artifact/tool*, and *object* and explains human activity as a semiotic interaction in a manner that does not rely on stimulus–response associations.

Member checking Member checking is a qualitative research data collection method that involves investigators presenting the data and analysis results to members and stakeholders of the participant community and receiving their feedback.

Naturalistic inquiry Naturalistic inquiry is a term that was popularized by Lincoln and Guba (1985) when they proposed alternative methods for research within social sciences that did not rely on quantitative methods. Naturalistic inquiry takes place in the participants' setting rather than in the laboratory, and many of the ideas that were shared by Lincoln and Guba have become critical elements within various qualitative research approaches.

Object The object in activity systems analysis is the goal, motive, or reason for subjects' to participate in an activity. The object is referred to by some authors as the objective.

Object-oriented activity Object-oriented activity is the mediated action process in which individuals and groups of individuals participate driven by their goals and motives.

Open coding Open coding is one of the steps in the constant comparative method that involves an intense microscopic examination of the data set. This helps investigators to identify the complexities involved in participant activities.

Orienting activity The orienting activity is a theoretical construct introduced by Galperin (1989) to address problems in internalization introduced by Vygotsky. Orienting activity helps to explain mental activities as the ability that allows

human beings to explore, examine, and predict potential results of actions they prepare to initiate.

Outcome The outcome in activity systems analysis is the end result of an activity.

Participant observer continuum The participant observer continuum is a conceptual tool introduced in Glesne and Peshkin (1991) and in Glesne (2005) that describes various roles that investigators can take in qualitative research. The continuum begins with observer at one end and with full participant at the other end.

Particularization Particularization is a concept introduced in Stake (1995) that emphasizes that the purpose of case study research is to understand the particularities of the phenomenon being investigated rather than understanding how it applies to other situations.

Peer debriefing Peer debriefing is a data collection method in qualitative research in which investigators find a colleague who was not involved in their study, introduce him/her to the study, and have that person examine the preliminary analysis results.

Persistent observation Persistent observation is a qualitative data collection technique that takes place over a period of time that allows investigators to maintain a focus in their study by identifying and collecting data on participant experiences that are relevant and essential to the research question.

Petite generalization Petite generalization was introduced by Stake (1995) who said the purpose of qualitative case study research was to focus on the discussion of general findings within the case or cases being examined rather than making grand generalizable claims about a population based on what they learn about a representative sample.

Practical theory Practical theory is a genre of research that is concerned with how theory and research can be applied to improve practice.

Rule Rule in activity systems analysis is the formal or informal regulations that in varying degree can affect an activity.

Second generation activity theory Second generation activity theory, developed by A. N. Leontiev and Engeström, was a method for understanding and examining the collective nature of human activity by addressing the sociocultural elements of human activity, which Vygtosky did not directly address.

Selective coding Selective coding is a step in the constant comparative method in which investigators purposefully and systematically identify characteristic s of the data around a core family of codes that are most relevant and carries the message about what the investigators learned.

Stimulus recall analysis Stimulus recall analysis is a qualitative data collection method that involves investigators presenting excerpts of raw data in audio, video, or text format and record participant reactions and comments.

Study database A study database is a tool in qualitative research to maintain data. For the study database, investigators prepare an organized data file that is separate from the final report of the qualitative study.

Subject The subject in activity systems analysis is the individual or groups of individuals involved in an activity.

Systemic contradiction Systemic contradiction in activity systems analysis refers to the sources of influences within an activity setting that can put pressures on an activity. Tensions within an activity can arise from these pressures and affect the interactions among components of an activity system.

Tensions Tensions in activity systems analysis are pressures influenced by systemic contradictions that subjects encounter while participating in an activity. These pressures can stimulate or interfere with the subjects' abilities to attain the object.

Thick description Thick description in qualitative research was adopted from the field of anthropology originally discussed in Geertz (1973). It involves investigators sharing participant experiences with the reader/audience, including rich contextual information as well as key raw data from observations, interviews, and document analysis.

Third generation activity theory Third generation activity theory is the application of activity systems analysis in developmental research where investigators take a participatory and interventionist role in the participants' activities and change their experiences.

Three planes of sociocultural analysis Three planes of sociocultural analysis, a theoretical tool introduced in Rogoff (1995), consists of the personal, interpersonal, and institutional/community planes that help CHAT researchers and practitioners identify bounded systems to organize their data analysis and presentation.

Tool The tool in activity systems analysis includes social others and artifacts that can act as resources for the subject in the activity. The tool is referred to by some authors as the mediating artifact.

Triangulation Triangulation is one of the well-discussed methods for maintaining trustworthiness in qualitative research that involves collecting data from multiple sources to assure an accurate interpretation of participant experiences.

Trustworthiness Trustworthiness is a concept within qualitative research that is equivalent to validity and reliability in quantitative research. There are several methods associated with trustworthiness that investigators need to engage and disclose to others to maintain the rigor and quality of their study. There is a thorough discussion of this topic in Lincoln and Guba (1985).

Unit of analysis The unit of analysis is a conceptual metric that researchers refer to when identifying the variables or phenomena examined in their investigations. In CHAT investigations, the unit of analysis is the human activity.

Zone of proximal development The zone of proximal development is a metaphorical tool that Vygotsky used to explain the potential learning of children while collaborating in problem solving activities with an adult or peer. While it is one of Vygotsky's concepts that became very popular in North America, especially in Education, it is often misinterpreted. There is a thorough discussion on the zone of proximal development in Wells (1999).

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