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A Cultural-historical Activity Theory Analysis of Factors Affecting Technology Adoption by Higher Education Program Faculty

Rolando Jose Marquez
University of Central Florida

A CULTURAL-HISTORICAL ACTIVITY THEORY ANALYSIS OF FACTORS AFFECTING TECHNOLOGY ADOPTION BY HIGHER EDUCATION PROGRAM FACULTY

by

ROLANDO JOSE MARQUEZ
B. S. Boricua College, 1997
M. S. Ed. Long Island University, 2000

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ABSTRACT

Background: Researchers have revealed that among the reasons provided as barriers to the adoption of technology are: lack of technology resources, time, professional development and support (National Council for the Accreditation of Teacher Education, 1997; Parker, 1996; Sheldon & Jones, 1996; Sheldon & Jones, 1996; NCATE, 1997; Shelly, Gunter & Gunter, 2010, U.S. Congress, 1995). Several models used to explain the usage of technology within education such as the Technology Acceptance Model (TAM) have been somewhat ineffective in explaining or providing a holistic view of the factors that come into play when examining technology infusion and diffusion as they account for a limited percentage of variance (Legris, Ingham & Collerete, 2003; Pan, Gunter, Sivo & Cornell, 2005).

Purpose: To better understand the choices that faculty members make in their use of educational technologies and media and to determine why some technologies such as blackboard have been widely adopted, but others have not. The following research question was formulated to guide the study: "Why do faculty members in higher education make the instructional choices they do with respect to educational technologies and media? Also, how can the use of Cultural Historical Activity Theory (CHAT), as a more robust framework, offer an increase in explanatory power to better enable the understanding of a multitude of factors that impact the adoption and use of certain media technologies?

Setting: A technology rich department at a college of a large urban university in the Southeastern United States.

Participants: Three faculty members who taught in the department.

Research Design: Qualitative multi-site case study informed by Engeström's Cultural Historical Activity Theory (CHAT) (Engeström, 1987).

Data Collection and Analysis: Document analysis, individual interviews, and laboratory and classroom observations provided data. Qualitative data analysis that employed qualitative inquiry research was informed by Creswell's "data analysis spiral" and Engeström's CHAT.

Findings: Visits at the institution presented several of the key ideas in the CHAT framework including contradictions within the media selection activity and tensions at the primary, secondary, tertiary and quaternary levels. Additional themes included group work, autonomy, media as a tool to achieve learning goals, caring for students, early adopters, and relevance with current trends.

I dedicate my dissertation work to my family and friends. A special feeling of gratitude to my mother and best friend, Grace Berrios; whose unconditional love, patience, words of wisdom, and untiring prayer, ring in my ears. You are my hero.

I also dedicate this dissertation to my mentor and guardian angel PB, who has taken me under his wing and whose no-nonsense attitude and tough love made this possible. I hope I can do the same for many others who embark on this journey.

Last, but certainly not least, no words can truly express my heartfelt gratitude to my God, whose love and mercy endure forever. By His grace I am here. "I can do everything through Him who gives me strength." (Phillippians 4:13). Thank you Lord for carrying me in your loving arms when I felt like I was walking alone.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

CHAT	Cultural-Historical Activity Theory
FTP	File Transfer Protocol
HTML	Hyper Text Markup Language
PDF	Portable Document Format
TAM	Technology Acceptance Model
TLC	Technology Learning Cycle
TRA	Theory of Reasoned Action
ZPD	Zone of Proximal Development

CHAPTER 1
THE PROBLEM AND ITS CLARIFYING COMPONENTS

Introduction

The value placed on technology by society has grown almost immeasurably due to the beneficial impact on almost every aspect of the daily life of the world's citizens and their interaction with their surroundings. Cars, microwave ovens, smart phones, smart boards, and laptops are all examples of technology that mankind has come to depend on to achieve specific goals.

An example of this dependence on technology has been the advent of distance education and its impact worldwide. At the Indira Ghandi National Open University, the number of students enrolled in distance education courses exceeded two million, making it one of the larger universities in the world with over 2,000 centers throughout the country and enrolling 24% of the 10 million Indians engaged in higher education (Rajasingham, 2009). Though the need to serve students regardless of geographical location has been evident, the debate on the use and adoption of technology in the field of education has been ongoing. Supporters of technology integration in education have encouraged the infusion of technology into the curriculum to meet the needs of 21st century students (Levin & Wadmany, 2008; McCune & Entwistle, 2010). Opponents, however, have argued that the current level of integration in education leaves much to be desired. They have questioned the usefulness of technology in educational settings (Bambara, Harbour, Davies & Athey, 2009). The adoption and usage of technology

within the field of education has continued to be a widely debated and controversial subject.

As early as the 1960s, Finn (1964) posited that technology-based learning had no inherent advantage or disadvantage over other methods of learning. He proposed that technologies provide ways of accomplishing tasks that are not new and readily obvious. Some 20 years later, Clark (1983) expressed similar opinions in regard to educational instructional media, which resulted in heated debates among educators. Clark (1983) has since changed some of his arguments. Both Finn (1964) and Clark (1983) resonated in their respective times that technology was not what causes change, but that change occurs because of new ways of doing things that are enabled by technology. This difference of opinion on the place of technology in education has continued to promote a great divide between educators (Bates, 2005).

Much of the research (Drost & Abbott, 2000; Olive, 1994; Russell, Bebell, O'Dwyer, & O'Connor, 2003) conducted in the area of technology diffusion in teacher education has been centered on course design, professional development, and faculty training (Wang & Patterson, 2006). Unfortunately, organizational change often has not been taken into account as an essential component of technology diffusion. Despite the push for technology integration over the past few decades, the results have been less than promising (Sivin-Kachala & Bialo, 2000). In fact, Cryan and Teclehaimanot (2003) reported "the absence of technology-rich teaching strategies is disturbing considering the amount of money and resources devoted to technology enhancement in our educational system" (p. 3882). This has also been validated in a study conducted by Lei (2010).

Technology in one form or another has long been present in the education arena (Saettler, 1967). For the purposes of the present research, however, it was important to understand the development of educational technologies and media in the field of education and their influence on teaching. Thus, this chapter has been organized to provide a brief history of educational technologies and media in education. This historical overview was limited to the time period of initial use of audio and video technologies in education up to the time of the present study. This limitation was intentional so that the use of audio and video technologies in higher education in the United States, particularly in meeting the needs of niche audiences, could be highlighted (Bianchi, 2008; Lazzari, 2009). This historical review was essential to understanding the role that educational technologies and media have played and continue to play in education as well as to establish a context for the research that was conducted for the present study.

Research Problem

The purpose of this qualitative inquiry was to better understand the choices that faculty members make in their use of educational technologies and media and to determine why some technologies such as blackboard have been widely adopted, but others have not. Traditional technology models have been somewhat ineffective in explaining the choices of educational media that faculty members make in higher education because they cannot account for all the external factors present within an environment (Hess, Joshi & McNab, 2010).

History of Audio and Video in Education

According to the archives for the Association of Educational Communications and Technology (n.d.), examples of the use of educational media were first observed during the early 20th century. Examples of audio and video tools in education have ranged from audiotapes, slide projectors, overhead projectors, and computers to the more traditional chalkboard, pencil and paper, all of which are used to connect the teacher and learner in conveying the content of courses (Keegan, 1988).

The lengthy history of audio and video in the field of education provides a prime example of a technology that has changed education. With close ties to distance education because of its importance in aiding the learning process, educational media (audio or video) has played a crucial role in education (Baggaley, 2008; Wartella et al., 2010).

Usage of audio in education, in particular radio, has been traced to 1921 when the first educational radio licenses were granted to the Universities in Salt Lake City, Wisconsin, and Minnesota (Casey, 2008). Live educational radio shows reduced the instructional delivery time in contrast with its predecessor, the postal service). According to the Public Broadcasting Service (2003), by 1923, over one-tenth of all broadcast radio stations were owned by educational institutions and were delivering educational programming. Despite the popularity of instructional radio, only one college level course was offered by radio in 1940 (Public Broadcasting Service, 2003). Correspondence courses and instructional radio set the scene for the opportunities that would arise as a result of television technology.

The use of video, specifically television, as an instructional medium began as early as 1934 when the University of Iowa broadcast courses via television. According to the Public Broadcasting Service (2003), the Federal Communications Commission created the Instructional Television Fixed Service (ITFS) as a band of 20 television channels available to educational institutions to distribute broadcast courses. In 1963, the California State University system was the first to apply for ITFS licensing (Public Broadcasting Service, 2003).

The proliferation of distance education began garnering worldwide acceptance, spanning initiatives such as the British Open University in 1969 and the German FernUniversität in 1974. Meanwhile, the establishment of the Public Broadcasting Act in 1967 gave birth to the Corporation for Public Broadcasting (CPB) to promote the non-commercial use of television and radio. As a result of the linking of 140 stations by the CPB and American Telephone and Telegraph (AT&T), the formation of the Public Broadcasting Service (Public Broadcasting Service, 2003) came to fruition in 1969.

According to McLuhan (1964), the virtue of video as embodied through television, was (and has continued to be) its ability to carry audio, video, and textual information of all other media. By 1970, Coastline Community College created and implemented the first televised licensed college course broadcasted by KOCE-TV to other educational institutions in Orange County, California (Casey 2008). According to Kersey (n. d.) two years later, colleges in Miami-Dade, FL, Coasta Mesa, California, and Dallas, Texas were pioneers in telecourse offerings. Although technology choices were numerous at the time, the nature of teacher-student interactions remained cumbersome.

The use of satellite television by corporations in the 1980's to conduct training served as a catalyst for its use into education. Satellite systems brought education to some of the most distant locations in the United States. According to Schlosser & Anderson (1994), Learn/Alaska was created in 1984 and offered six hours of instructional television daily to one hundred villages, some of them only accessible by air.

The creation of the microprocessor by IBM fueled a revolution in the way we communicate with others on a daily basis (Casey, 2008). The usage of computers and particularly the World Wide Web have allowed users to link to some of the most remotes confines of the Earth. Through the use of multimedia, children in Brooklyn, New York can experience the sounds and sights of the animals in the vicinity of Mount Kilimanjaro, something they would not likely be able to see in their lifetimes. With the addition of high-speed broadband, learning over the Internet has become the next frontier, allowing institutions to better meet the needs of their students.

The relationship between educational technologies and education provide no guarantee that a particular technology will be adopted and become mainstream in the educational arena. As an example, researchers (Campbell, 2005; Eash, 2006; Lawlor & Donnelly, 2010; Liu et al., 2009; Selwyn, 2010) have recently focused on the application and use of audio and video (i.e. podcasting, videocasts) in teaching and learning in higher education. Research and published work have expanded to cover podcasting applications for the K-12 market, particularly as teaching and learning tools, which have provided enhanced learning experiences and remedial support in academic subjects and language acquisition (Ching, 2009; Goode, 2010; Richardson, 2009). This has been one of the

latest iterations among many technology trends taking place in the educational arena, e.g., Web 2.0, wikis, blogs, and screencasts. Some clear advantages have been displayed in the new applications. At the time of the present study, however, despite Apple purposing podcasting to academia with the introduction of iTunes University and partnerships with Stanford and Duke University to bring in digital format for students to use and learn anytime, anywhere, the new applications have not achieved mainstream status. This is one example where a technology has been slow to be adopted despite the potential benefits that it offers.

Numerous researchers have attempted to cite the barriers to technology adoption in higher education. Among the barriers named were (a) the lack of technology resources, (b) time, (c) professional development, and (d) support (Gunter, 2007; National Council, 1997; Gunter & Gunter, 2010; Parker, 1996; Sheldon & Jones, 1996; U.S. Congress, 1995).

Conceptual Framework

Several models, e.g., the Technology Acceptance Model (TAM), the Theory of Reasoned Action among others, have been used to explain the usage of technology within education. The TAM attempted to explain how users accept and adopt a technology. This model was used to explain how perceived usefulness and perceived ease of use influenced a user's decision on how and when to use that particular technology (Davis, 1989). This was also validated on a study conducted by Pan, Gunter, Sivo, & Cornell, 2005).

The current inquiry used Engeström's (1987) Cultural-Historical Activity Theory (CHAT). This framework takes a broader view of the contextual factors surrounding human activity such as instruction. The researcher anticipated that the broader perspective afforded by CHAT would provide additional insight beyond that of more narrowly focused traditional models.

Research Question

The following research questions were formulated to guide the study:

1. Why do faculty members in higher education make the instructional choices they do with respect to educational technologies and media?
2. How can the use of CHAT, as a more robust framework, offer an increase in explanatory power to better enable the understanding of a multitude of factors that impact the adoption and use of certain media technologies?

Implicit in these questions was the extent to which contextual factors such as community, work environment, availability of resources, policies and procedures, and professional development played a role in related decisions.

Design of the Study

This qualitative research design, which employed qualitative inquiry research, was designed around the researcher's role as an observer. The use of interviews and document analysis as the educational media selection choices in a department of a college

at the University of Central Florida were explored. The population was the faculty of the department. Detailed descriptions of the research methods are contained in Chapter 4.

Significance of the Study

This study was initiated to increase insight into the use of Engeström's (1987) Cultural-Historical Activity Theory (CHAT) as a more robust framework than alternative models for explaining the multitude of factors that impact the adoption and use of certain media technologies.

This study raises awareness of the factors that surround media selection activity systems such as teacher satisfaction, suitability of tools for teaching and learning outcomes, time demands, and departmental and institutional expectations for growth. Also, understanding the impact of these forces allows for improvement in teaching, program and course implementation, tool design, and general policy.

Technology adoption is more than a choice of tools. It involves the parameters in which individuals work with these tools and how faculty members use them to increase and aid in the teaching of the course content. It is a very dynamic and complex process with many variables that are in constant interaction. All stakeholders need to be aware of these interactions as they plan the choice, design, and implementation of technology at a classroom, departmental, or institutional level. Often, decisions about the tools are made at the administrative level with no input or feedback from the faculty who will be implementing them. These choices may not be the best ones for teaching, learning, and motivating students to learn.

This study revealed the tensions present in the activity system for a group of early adopter faculty members. It can be argued that these tensions would be significantly magnified for other adopter groups such as late majority or laggards. As such, there is the need to create awareness so that policy and tools can be modified to ease the process of technology adoption into higher education taking all of these factors into account.

The need for change is imperative because of the huge monetary investment in technology that has been put in place (PT3 Grant Objectives, 2000). Zisow (2000) stated that "technology is merely a tool" (p. 36) and stressed the importance of assessment and teaching in his statement that the aim of a quality education should be to "match learning styles with teaching style" (p. 38). Ali & Elmahdi (2001) expressed their belief that "the integration of technology into education has become a necessity and not luxury, especially for faculty in higher education" (p. 72). Guhlin (2002) supported this concept and stated that empowering teachers with technology "can impact student achievement" (p. 40).

Definitions

Engeström's Cultural-Historical Activity Theory (CHAT): With origins in the Soviet psychology movement, the CHAT framework examines an activity system consisting of an actor, the object upon which an action is performed, the community within which the activity is embedded, and the way tools mediate the action (Engeström, 1987).

File Transfer Protocol (FTP): As it names implies, FTP is used to transfer files

between computers on a network. FTP can be used to exchange files between computer accounts, transfer files between an account and a desktop computer, or access online software archives (Indiana University, 2010).

Hypertext Markup Language (HTML): HTML is the language for describing the structure of Web pages. HTML gives authors the means to publish online documents with headings, text, tables, lists, and photos. It also allows the user to retrieve online information via hypertext links at the click of a button (W3C, 2010).

In-service teachers: In-service teachers are those who have completed their training to become a teacher and are currently serving at a school.

Portable Document Format (PDF): Portable Document Format is a file format created by Adobe Systems in 1993 for document exchange. PDF is used for representing two-dimensional documents in a manner independent of the application software, hardware, and operating system (Adobe Systems Incorporated, 2006).

Pre-service teachers: Pre-service teachers are those who have declared an education major but have yet to complete their training to become a teacher.

Technology Acceptance Model (TAM): TAM is a model that attempts to explain how users accept and adopt a technology. It suggests that perceived usefulness and perceived ease of use influence a user's decision on how and when to use that particular technology (Davis, 1989).

Technology integration: Technology integration refers to combination of all technology parts, such as hardware and software, together with subject-related content enhance student learning and accomplish curriculum goals (Gunter & Baumbach, 2004).

Technology Learning Cycle (TLC): Although not a model per se, the Technology Learning Cycle is a framework conceptualized by Wedman and Diggs (n. d.) that provides users with a structure to keep informed about technology. It is based on learning phases that encourage decision making about learning and using new technology tools.

Theory of Reasoned Action (TRA): TRA is a theory developed from social psychology setting that suggests that voluntary behavior is predicted by individuals' attitudes toward that behavior and how those individuals think other people would view them if they performed the behavior (Fishbein & Ajzen, 1975).

Web 2.0: The term Web 2.0 is associated with web applications that facilitate participatory information sharing, interoperability, user-centered design, and collaboration on the World Wide Web (TechPluto, 2009).

Zone of Proximal Development (ZPD): ZPD is a concept developed by Vygotsky (1978) to describe the difference between what a learner can do with and without assistance.

Organization of the Dissertation

Chapter 1 of the dissertation has presented the problem and its clarifying components. The conceptual framework, research question, definitions, and significance of the study were described. An overview of the research design was also presented. Previous literature relevant to the research is reviewed and critiqued in Chapter 2. Chapter 3 contains an expanded discussion of Cultural-Historical Activity Theory (CHAT) as a conceptual framework. A detailed description of the methods used in the

research, including data collection procedures and ethical considerations, is presented in Chapter 4. Chapter 5 contains the results of the analysis of the data. Chapter 6 is devoted to a discussion of the research results, implications of the study, and recommendations for further study.

CHAPTER 2
LITERATURE REVIEW

Introduction

The adoption and usage of technology in an educational setting has been predominantly evaluated in conjunction with pre-service and in-service teachers (Ertmer & Ottenbreit-Leftwich, 2010; Louis & Grant, 2010; Teo & Noyes, 2010). This study was conducted to evaluate technology adoption in a more general manner within the framework of higher education and to understand the choices that higher education faculty members make in their use of educational technologies and media. Thus, the relevant literature on the adoption of educational technologies and media by higher education faculty was examined. The first section of the review addresses foundation concepts of technology adoption. The studies that have taken place examining this phenomenon are then explored. Finally, the literature related to the various mainstream models for investigating technology adoption, including assessments and outcomes, was examined.

Conceptual Framework

The conceptual framework supporting this study was based on theoretical and empirical research. It was illustrated by the researcher and is depicted in Figure 1. The theoretical research was based on Engeström's Cultural-Historical Activity Theory (1987) which posited that "when individuals engage and interact with their environment, production of tools results. These tools are 'exteriorized' forms of mental processes, and

as these mental processes are manifested in tools, they become more readily accessible and communicable to other people, thereafter becoming useful for social interaction" (Fjeld et al., 2002, p. 153). Engeström's CHAT attempts to provide a holistic model to examine a problem or situation by taking into account the numerous factors present in and taking part in that particular scenario and the effect of their interaction on the outcome of the scenario rather than examining the scenario in a vacuum.

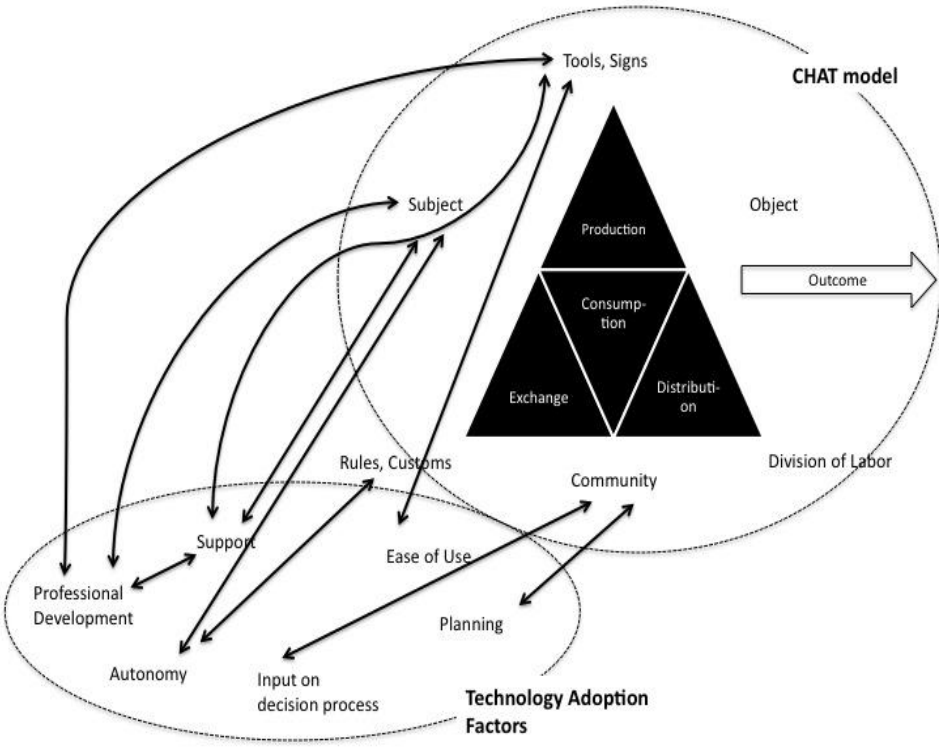

Figure 1. Conceptual diagram of the connection between CHAT model and technology adoption factors.

A variety of studies embody the empirical foundations of this research. This section details the extant discussions of the various topics that converge on the currently proposed study.

The empirical foundations for this study were derived from three distinct areas of research: (a) educational change, (b) technology diffusion, and (c) educational/ instructional media. The adoption of technology in general is a construct that has been evaluated in both the corporate world and educational settings (Boothby, Dufour & Tang, 2010; Kakabadse, 2010; Zivin & Neidell, 2010). Furthermore, the adoption of technology has been studied from the point of view of perceived usefulness and ease of use, as defined by the Technology Adoption Model and other proposed models. The final section describes the Technology Acceptance Model (TAM) and other commonly used models to explain technology adoption and usage. An explanation of Cultural Historical Activity Theory (CHAT) and the contributions it offers when compared to other models is contained in Chapter 3.

Technology Adoption

Traditionally, the adoption of a technology has been a public vow of confidence to fix a certain problem or make a task easier or more effective (Davis, 1989). There are two general ways in which technology adoption takes place: a top-down approach where administrators prescribe the technology based on their perceptions and decisions. The other model is a grass-roots approach where the use of technology comes from the users

of the technology to serve their own purposes, creating a body of users that exert pressure on management to adopt such technology (Carr, 1999).

As a result of technological advances, several models have been presented to explain the adoption and usage of technology.

Diffusion of Innovations

The French sociologist , Tarde (1890) is believed to have been the first student of the concept of innovation; however, Tarde's theories became overshadowed by the insights of Durkeheim, a French positivist sociologist. Tarde's theories did not become famous until U.S. scholars adopted them and brought on a renaissance movement (Toews, 1999). Rogers (1986) was considered to be an "expert" of adoption/diffusion research since the publishing of Diffusion of Innovations (Carr; n.d.). Basing his work on the earlier research of Bryce (1943), Bryce and Gross (1950), and Gross (1942), Rogers (1986) tracked the patterns of hybrid seed corn by farmers and described how new ideas and technologies spread in different cultures. The technology adoption "lifecycle" describes the adoption or acceptance of a new innovation according to the demographic and psychological characteristics of defined adopter groups. The process of adoption over time has been typically illustrated as a classical normal distribution or "bell curve" as shown in Figure 2. Rogers' (1964) model indicated that there were five categories of adopters: "innovators, early adopters, early majority, late majority, and laggards" (p. 150). The model also highlights the fact the first group of people to use a new product are the innovators, followed by early adopters, the early and late majority, and the laggards.

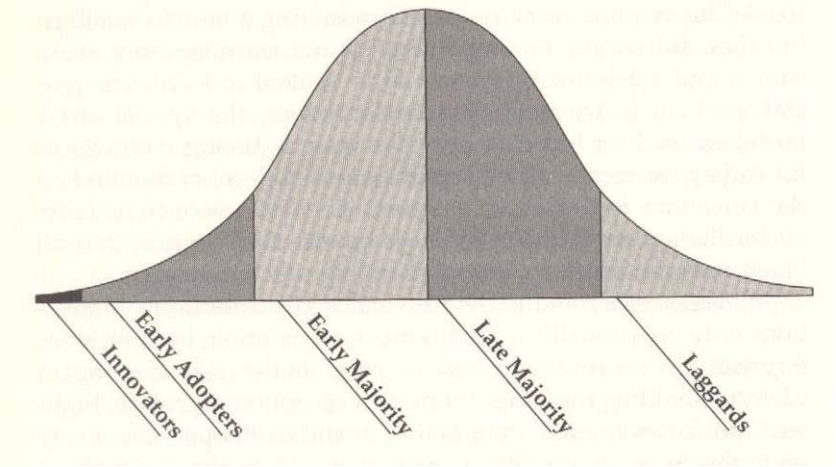

Figure 2. Rogers' Technology Adoption Life Cycle.

Bryce & Gross (1943) identified adoption as a process in their research. Rogers in his 1964 *Diffusion of Innovations* categorized the process of adoption as a five-step process consisting of awareness, interest, evaluation, trial, and adoption. He later revised the terms, which at the time of the present study, consisted of knowledge, persuasion, decision, implementation, and confirmation. Rogers' five stages in the innovation process are displayed in Figure 3.

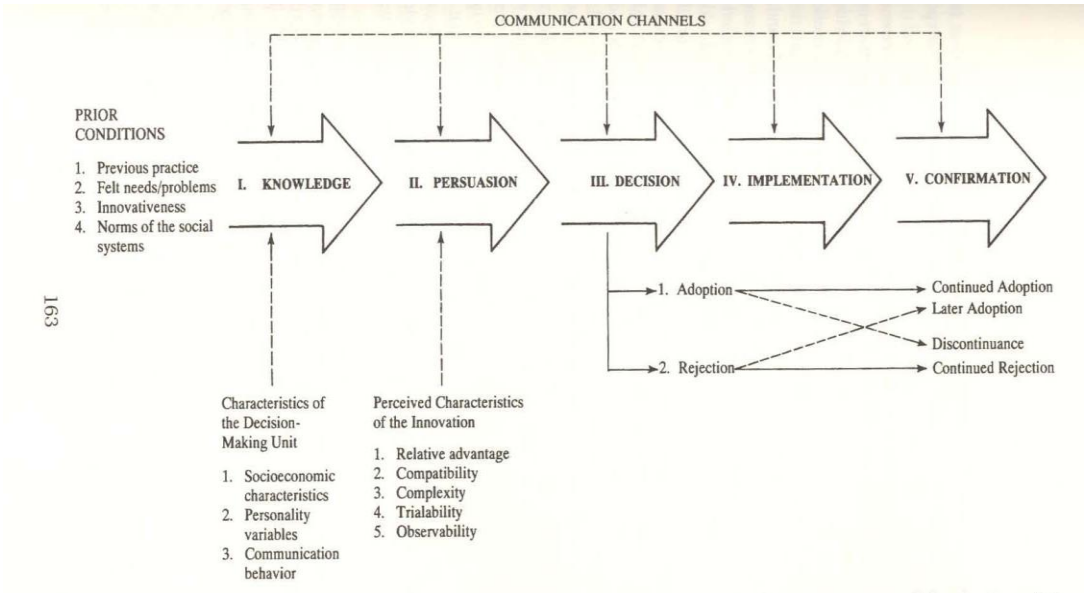

Figure 3. Steps in the decision innovation process.
Source: *Diffusions of Innovations*, 4th Ed., Everett M. Rogers. Copyright © 1995 by Everett M. Rogers. Copyright © 1962, 1971, 1983 by the Free Press, a Division of Simon & Schuster. Reproduced with permission of the publisher. All rights reserved.

Although Rogers' terminology has changed, the descriptions of these categories have remained similar throughout the editions. Table 1 lists each of the stages in the decision innovation process with the defining characteristics of each.

Rogers (1964) defined the rate of adoption as the relative speed with which members of a social system adopt an innovation. The speed of innovation has usually been measured by the length of time required for a certain percentage of members of a social system to adopt an innovation (p.134).

Table 1

Characteristics of the Decision Innovation Process

Stage	Defining Characteristics
Knowledge	An individual is exposed to an innovation but lacks information about an innovation and had not been encouraged to find information about the innovation.
Persuasion	An individual is interested in the innovation and is actively seeking information and further details on the innovation.
Decision	The innovation is evaluated in terms of advantages/disadvantages and a decision is made whether to reject or accept the innovation. Rogers notes that it is the most difficult stage to acquire empirical evidence due to the individual nature of this stage.
Implementation	An individual employs the innovation to varying degrees and determines the usefulness of the innovation. The individual may look for further information as needed.
Confirmation	The individual finalizes the decision of continuing to use the innovation and may use it to its fullest potential.

He also posited a set of five characteristics that influenced an individual's likeliness of adoption or rejection of an innovation. Table 2 lists each of the characteristics of innovations with its defining features.

When examining diffusion research, individuals have typically been classified in terms of categories on the basis of innovativeness. To this end, Rogers recommended five categories of adopters on which to standardize usage categories in diffusion research displayed in Figure 2. Table 3 describes the defining features of each adopter category.

Table 2

Intrinsic Characteristics of Innovations

Name	Defining Feature
Relative Advantage	The difference in improvement of an innovation between its current form and a previous generation.
Compatibility	The degree of the innovation to be incorporated into an individual's life.
Complexity	The degree of difficulty of the innovation to be used on a regular basis.
Triability	The degree of an innovation's testability during the adoption process.
Observability	The degree of visibility of the innovation to others as a vehicle for communication between peers, resulting in adoption or rejection.

Much of the evidence for the diffusion of innovation gathered by Rogers came from agricultural methods and medical practice; however, various computer models have been created (Veneris, 1984; 1990). Included was a system dynamic that simulated the diffusion of innovations through the use of differential equations. Also, Carr (1999) has done extensive research on the topic of diffusion research that validates the model.

Table 3

Adopter Categories in Innovation Adoption

Name	Defining Feature
Innovators	The fastest category to adopt an innovation, taking more risks.
Early adopter	The second fastest category for innovation adoption. This category has the highest opinion influence between all adopter categories. They are younger in age, possess a higher social status, advanced education, and are more socially forward than late adopters (p. 185).
Early majority	Users in this category adopt an innovation after a varying degree of time. This time of adoption is longer than the innovators and early adopters. Early majority tend to be slower in the adoption process, have above average social status, contact with early adopters, and show some opinion influence.
Late majority	Users in this category adopt an innovation after the average member of society has. They approach an innovation with a high degree of skepticism and after the majority of society has adopted the innovation. They also have below average social status, are in contact with others in the early and late majorities, and have little opinion influence.
Laggards	This category of adopters is the last one to adopt an innovation. Individuals tend to be advanced in age, while possessing the lowest social status.

In *Crossing the Chasm*, Moore (2002) made a special case in applying Rogers' (1964) *Diffusion of Innovations* to technology based on his experience in the business world. *Crossing the Chasm* was intended as a marketing text that outlined the essentials of marketing high tech products during the early start up period, and at the same time, expanding on Roger's (1964) Diffusions of Innovations model. In the book he refers to the difference between discontinuous and continuous innovations. Discontinuous referred

to those innovations that require changes in current mode of behavior. Continuous innovations refer to the normal upgrading of products of services without requiring a modification of current behavior. Termed as the Technology Adoption Life Cycle and central to the high-tech marketing model, it encourages the working of the bell curve from left to right. It makes use of the endorsement of innovators to provide a sales pitch for the early adopters; which in turn provides credibility and a case for adoption by the early majority. This process repeats itself with each subsequent group on the bell curve. The key is to keep the process moving smoothly as one works the curve. However, there are pitfalls to the high-tech marketing model.

Moore (2002) stressed the existence of "cracks in the bell curve" (p. 17). The first crack was between the innovators and the early adopters and it occurred when a "hot technology product (e.g., Second Life) cannot be readily translated into a major new benefit" (p. 17). Mayle (2006) examined the nature of innovation and the broader issues surrounding change in his book, *Managing Innovation and Change*. Similarly, Friedman talked extensively about innovation and the changes it has brought upon as a result of globalization is his books, *The World is Flat: A Brief History Of The Twentieth-First Century* (2005), and *Hot, Flat and Crowded 2.0: Why We Need a Green Revolution--and How It Can Renew America* (2009). The second crack to which Moore referred occurs between the early and late majority. It manifests itself when the early majority are willing to become technologically competent but the late majority are not as inclined to do so. At this point, a product needs to be made easier to adopt in order to be successful. This relates to what Gladwell talked about in his book, *The Tipping Point*. Gladwell (2000)

referred to the tipping point as "the moment of critical mass, the threshold, the boiling point." (p. 12). He compared the ability of ideas, products, behaviors, and messages to spread like viruses. He also described the three rules of epidemics (or agents of change) in the tipping points of epidemics. The first agent of change is the Law of the Few. This law states that the success of a social epidemic depends on people with an exceptional set of social gifts. These people are called connectors, mavens, and salesmen (Gladwell, 2000). Connectors refer to the people that bring people together. Mavens are the information brokers, people who can be relied on to connect others with new information. Salesmen are the persuaders, people with powerful negotiation skills. The second agent of change is The Stickiness Factor. This factor refers to the ability of a specific content of a message to render its impact memorable. The last agent of change is the Power of Context, which states that human behavior is sensitive and strongly influenced by its environment.

The more marked crack is the one to which Gladwell (2000) referred as the chasm--a deep and dividing gap that separates the early adopters from the early majority. This is the most alarming and intolerant transition in the Technology Adoption Life Cycle. This occurs as a result of marked differences between the early adopters and the early majority. The early adopters are looking for a radical change in order to get ahead of their competition and gain a business advantage. In education, early adopters are looking to innovate. As such, they expect change, are determined to embrace a new product, champion its use, and deal with the inevitable glitches and bugs that accompany any young technology in its first generation existence.

By contrast, the early majority awaits improvement on existing methods. They are looking for an evolution rather than a revolution. They expect the technology to be thoroughly tested and integrated with their existing technology so that the product "works." Moore (2003) considers early adopters inappropriate references for the early majority. Because of their concern to not disrupt their existing operations, the early majority relies on good references for their buying decisions. Typically, the only suitable reference for a member of the early majority is another member of the early majority, but no early majority member will buy a new product without references. This creates a disconnect, the chasm to which Moore (2003, p. 17) often refers, and reveals a flaw in the design of the model. Good references are those considered suitable so that their experience can be considered trustworthy enough to be used in the decision making process. In the education context, good references for the early majority would consist of peers or other departments that are using a particular tool.

Theory of Reasoned Action

The Theory of Reasoned Action was developed by Fishbein and Aizen as an enhancement to the Information Integration Theory (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Information Integration Theory, developed and tested by Anderson (1971,1981a, 1981b, 1991), explored how attitudes are formed and changed through combining existing thoughts with new information. Essentially, ideas in a persuasive message are conveyed as information with two distinct qualities: value and weight (Anderson, 1971, p. 172). Value refers to the evaluation of the information (favorable or

unfavorable) while the weight refers to its importance; however, unlike the Information Integration Theory, the Theory of Reasoned Action possesses two important changes. First, it adds another element, behavioral intention, to the process of persuasion. The focus resides on behavior rather than the prediction of attitudes; however, it is also recognized that there are situations that limit the influence of attitude on behavior (Ajzen & Fishbein, 1980; Belleau et al, 2007). Behavioral intention becomes a middle point between stopping at attitude predictions and actually predicting behavior. Because it separates behavioral intention from behavior, the Theory of Reasoned Action also discusses the factors that limit the influence of attitudes (or behavioral intention) on behavior. Figure 4 illustrates the model of the Theory of Reasoned Action.

The second change is that the Theory of Reasoned Action employs the concepts of attitudes and norms to predict behavioral intent. In situations where attitudes differ from the dictates of relevant norms, both factors influence behavioral intent.

Thus, reasoned action predicts that behavioral intent is created or caused by one's attitudes and subjective norms. As with Information Integration Theory (Fishbein and Ajzen, 1975; Sheppard, Hartwick & Warshaw, 1988), attitudes are composed of what Fishbein and Ajzen termed the evaluation and strength of a belief. Subjective norms, the other component influencing behavioral intent, is composed of (a) normative beliefs which consist of what one believes others expect and (b) motivation to comply which addresses the importance of performing as others expect. The Theory of Reasoned Action asserts that beliefs influence attitudes, which lead to intentions and generate behavior. The Theory of Reasoned Action has been particularly useful in explaining some of the

reasons why an attitude will not result in the expected behavior. This is because people do not always do what they intend to do.

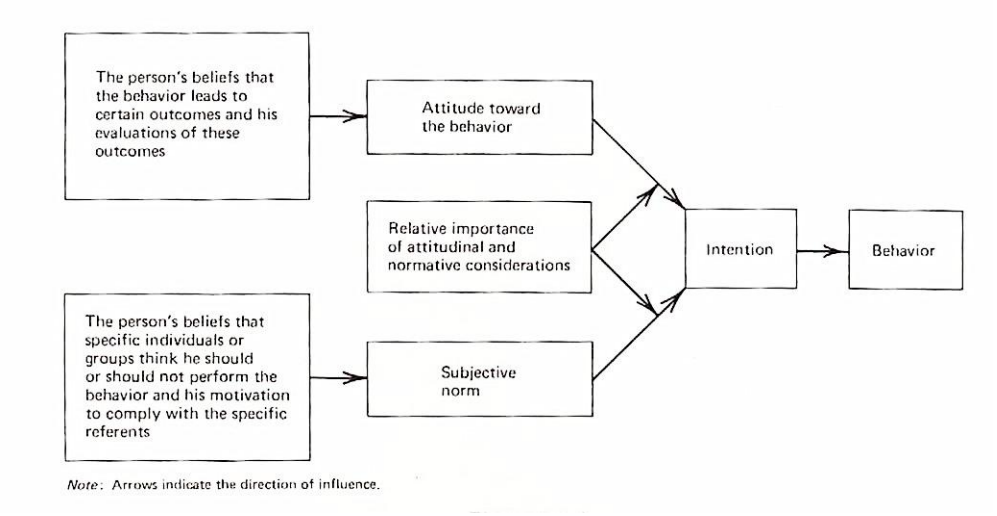

Figure 4. Theory of Reasoned Action.
Source: *Understanding Attitudes and Predicting Social Behavior*, by Ajzen & Fishbein. © 1980. Reprinted by permission of Pearson Education.

Technology Acceptance Model

The Technology Acceptance Model (TAM) was proposed by Davis (1989) as a method to examine end-users' acceptance of information technologies. This model is grounded in social psychology theory in general as well as the Theory of Reasoned Action (TRA) in particular (Fishbein & Azjen, 1975). This model has also been widely regarded as a robust and predictive method when compared to competing models such as the Theory of Reasoned Action and the Theory of Planned Behavior (Venkatesh & Davis, 2000). Davis (1986, 1989) introduced the following constructs in the original TAM :

perceived usefulness, perceived ease of use, attitude, and intention to use. In the model, displayed in Figure 5, perceived usefulness and perceived ease of use form an end-user's beliefs about a technology and predict the user's attitude toward the technology, thereby creating an indicator of acceptance.

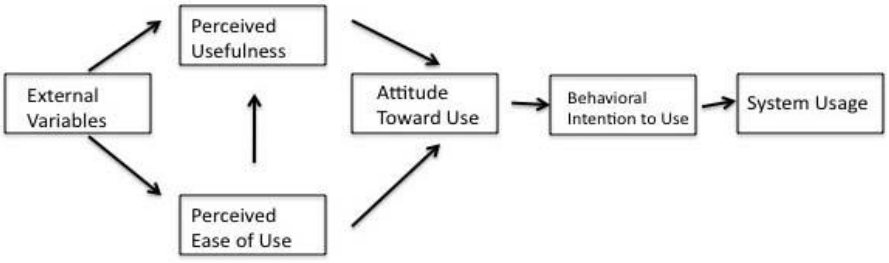

Figure 5. The Original Technology Acceptance Model (Davis, 1989)
Adapted from Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance. *MIS Quarterly, 13*(3), 319-340.

One of the limitations of the original TAM model was a measurement bias because of the grouping of multiple items measuring each construct. This happened because the multiple questions measuring intention to use, perceived usefulness, and ease of use were grouped together. Several empirical studies have shown that the psychometric properties of measurement scales can be affected by the item order in a questionnaire (Bradburn, 1982; Budd, 1987; Harrison & McLaughlin, 1991; Pan et al., 2005; Schuman & Presser, 1981). This created a carryover effect and inflated the model's validity and reliability (Davis & Venkatesh, 1996). Davis, therefore, proposed a new version of the TAM, aptly named TAM2, which included subjective norms and was

tested with longitudinal research designs. Figure 6 provides a representation of the revised TAM model (TAM2).

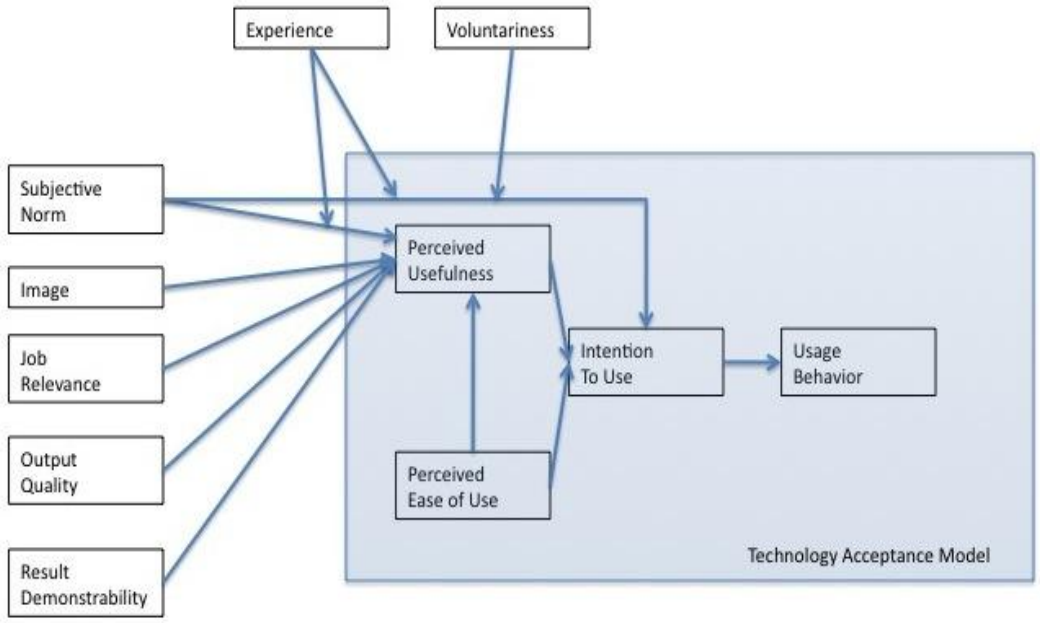

Figure 6. TAM2: Extension of the Technology Acceptance Model (Davis, 1996). Adapted from Davis, F. D. (1986). *A technology acceptance model for empirically testing new-user information systems: Theory and results.* Doctoral Dissertation, MIT Sloan School of Management, Cambridge, MA.

These two models, TAM and TAM2, explain approximately 40% of a system's use. Legris, Ingham , and Collerette (2003) concluded that TAM was useful but needed to be integrated into a broader model that takes into account factors related to processes involving human and social change. Another challenge in applying the TAM model has

been that it explains usage but does not necessarily address adoption (Bagozzi, Davis, & Warchaw, 1992; Pan et al., 2005; Turner et al., 2010).

Technology Learning Cycle

Although not a technology model per se, the Technology Learning Cycle (Wedman & Diggs, n.d) is a learning model for faculty development. It was developed based on the views of Sprague, Kopfman, and Dorsey (1998) and the Chickering and Ehrmann's (1996) seven principles of good practice with some modifications applicable to technology (Chickering & Ehrmann, 1987). It is a framework that has provided users with a model for keeping track of emerging technology. It was based on the principle that *faculty must be lifelong learners of educational technology*. As such, they must develop a personal process for learning and using new technology (Wedman & Diggs, n.d). As a result, teacher education faculty and pre-service teachers develop self-concepts of themselves as technology users and support individualized faculty development needs (Georgina & Hosford, 2009; Howland & Wedman, 2004). Figure 7 displays the five major phases of the Technology Learning Cycle: (a) awareness; (b) exploration and filtration; (c) learning; (d) personal and professional application, and (e) sharing and reflection. Each phase is interdependent on the others and essential to complete the cycle.

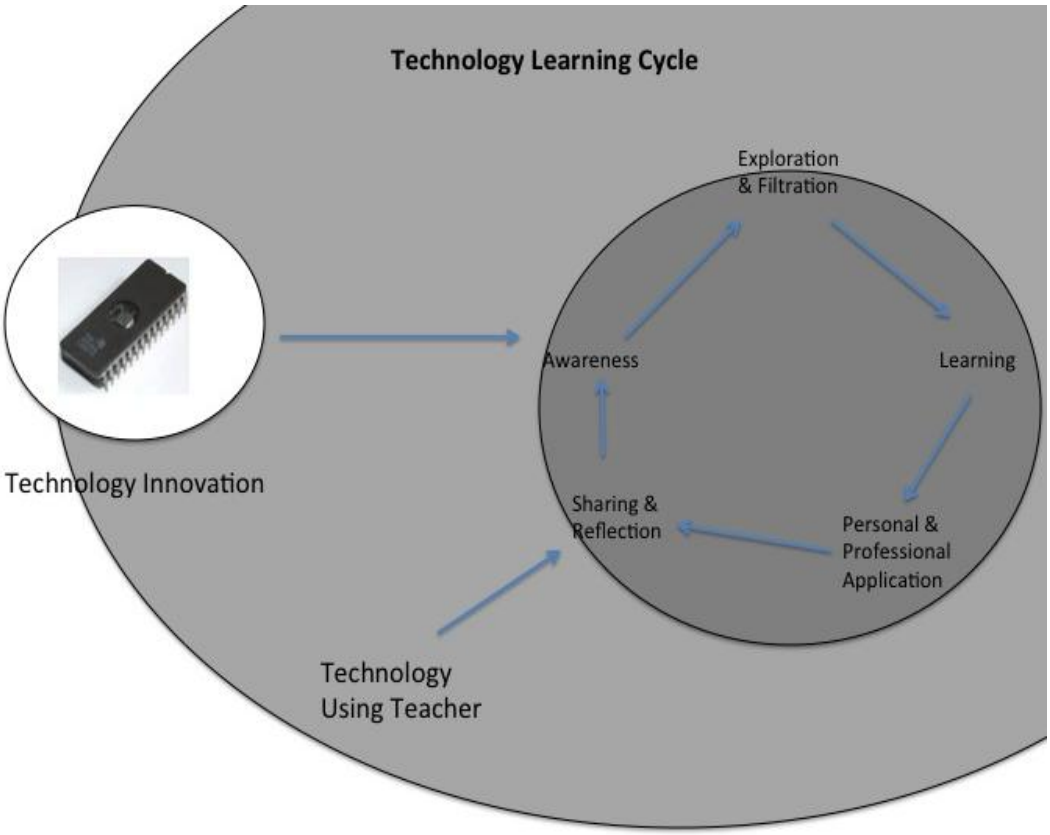

Figure 7. Technology Learning Cycle phases (Howland & Wedman, 1974). Adapted from Howland, J., & Wedman, J. (2004). A process model for faculty development: Individualizing technology learning. *Journal of Technology on Teacher Education*, *12*(2), 239-263.

In the awareness phase, a learner is open to new innovations as he wishes to expose himself to a new technology. During the exploration and filtration phases, the learner considers the functions, availability and usefulness of different innovations as discovered in the previous stage and selects a technology to learn. The learning phase provides an opportunity for the user to acquire the necessary technical skills to utilize and

master the technology introduced. In the application stage, the user incorporates the instructional technology into the teaching methodologies to support instruction. In the sharing and reflection stages, the participants reflect on the whole process of integrating the technology into the curriculum. The model is not a linear one, as it acknowledges that individuals may be in multiple phases concurrently depending on the technology (Howland & Wedman, 2004; Jarvenpaa & Makinen, 2007).

Related Research: Adoption of Technology

Since the beginning of the millennium, most K-12 public schools nationwide have had access to computer technology, and 98% of them were reported to be Internet-connected in 2001(Cattagni & Farris, 2001). Beginning teachers, however, have reported that they do not feel adequately prepared to integrate technology into their teaching practices (Evans & Gunter, 2004; Office of Technology Assessment, 1995; Sprague et al., 1998). The responsibility for preparing pre-service teachers to use technology in instruction has resided within teacher preparation programs and, by extension, with teacher educators. Developing and implementing effective technology training has been particularly difficult in higher education because of differing faculty interests, levels of individual autonomy, and technology expertise (Howland & Wegman, 2004).

The following section of the literature review was focused on literature and studies related to the adoption of technology in the higher education arena. Addressed are (a) generally perceived barriers to adopting technology, (b) attitudes, and (c) professional development as predictors of technology adoption and usage.

Barriers to Using Technology in Higher Education

In the mid-1990s, researchers indicated that teacher preparation programs were not adequately training future teachers to use technology in their classrooms. In 1995, the Office of Technology Assessment reported on a study of four sites in response to technology integration in education programs (Mergondoller, Johnston, Rockman, & Willis, 1994). On its 1997 report, the National Council for Accreditation for Teacher Education (NCATE) concluded that universities were not meeting their responsibility of training teachers to teach with technology, specifically stating that "a majority of teacher education programs are falling short of what needs to be done" (p. 6). They recommended institutions develop a vision and a plan detailing how they intended to integrate technology into their preparation programs.

Several studies have concentrated on the barriers technology faces in education (Muir-Herzig, 2004). Researchers have reported lack of teacher time, limited access, cost of the technology, lack of vision and planning, and support to be among the main barriers that impede consistent use of technology (Shelly, Gunter, & Gunter, 2010).

Jacobsen (1998) conducted a study at two major North American universities regarding technology usage patterns, computer experience, self-efficacy, incentives and perceived barriers. The most commonly reported barriers were (a) perceived lack of time to learn how to use the technology, (b) learning new methods for teaching, (c) faculty complacency, (d) non-adoption unless forced, (e) importance of research over teaching, and (f) absence of recognition.

Strudler & Wetzel (1999) engaged in a follow-up study using the same four sites that the Office of Technology Assessment had studied in 1995. Their findings revealed advances had taken place in some teacher education programs. It also validated the *importance of a balance between support and pressure so as to avoid the resistance and alienation that could result from excessive pressure but not foster drift and waste as a result of little pressure and no support*. A need for strong and committed leadership to establish a vision and expectations for the institution as well as its faculty emerged as a theme in this research.

Finley and Hartman's (2004) research consisted of a case study using one large university to determine potential barriers to the integration of technology in teacher preparation courses. Several themes were identified in the research including the importance of linking technology with specific learning objectives rather than using new technology because it was new. Another theme, critical of technology, that surfaced was "technology uses us, we do not always use technology" (Postman, 1992, p. 7; Taylor & Gunter, 2006, 2009).

Algahzo (2006) conducted a study of university faculty at a college of education to determine faculty members' (a) technological competencies, (b) preference of professional development options, and (c) attitudes toward computers. Faculty reported barriers to adopting technology were concentrated on four distinct areas: *lack of time, lack of technical support, new equipment, and difficulties in the use of technology*. Another finding stressed the importance of *consistency between technology and learning styles*. It was concluded that faculty would experiment with technology if they believed it

was aligned with their teaching styles, if they were confident and knowledgeable, if they were supported and rewarded for doing so, and if they saw the usefulness from a pedagogical perspective. A final theme emphasized the need for direction and guidance from departmental leaders. This supported Bates' (2000) conclusion about the importance of the leadership of faculty chairs. Rice and Miller (2001) found faculty want to be involved in the administrative and technology planning, providing key input before technologies are adopted, and that administrators needed to ensure appropriate involvement.

There has been a perception that cultural and technical barriers play a significant role in the use of a technology (Berge, 1998; Berge & Mrozowski, 1999). Cultural factors relate to faculty's resistance to innovation and change, and technical factors focus on the reliability of the technology, connectivity, infrastructure, and technical support.

Pajo and Wallace (2001) conducted a study to analyze the barriers that impeded the adoption of Web-based courses by university faculty and categorized them into personal barriers, attitudinal barriers, and organizational barriers. Personal barriers included lack of knowledge skills, training, role models, and time. Attitudinal barriers were comprised of no faith in technology, unwillingness to work with technology, and concern about student access. Organizational barriers consisted of inadequate technical support, hardware, software, instructional design, and no recognition of value of online teaching. Similar studies have been conducted that validate these barriers (Belland, 2009; Bolliger & Wasilik, 2009).

Newton's (2003) literature review on the development and integration of technology in higher learning identified five factors that play a role in the process: (a) increased time commitment for academic staff, (b) lack of intrinsic/extrinsic rewards, (c) lack of strategic planning and vision, (d) lack of technical and pedagogical training, and (d) philosophical, epistemological, and social objections. This is also confirmed in a study conducted by Mitchell & Gunter (2004) on technology integration in higher education.

Attitudes as Predictors of Usage

According to Albirini (2006), attitudes can be considered as a major predictor of the use of new technologies in instructional settings, and attitudes can be more important than skill sets in dealing with advances in teacher technology integration. Attitudes of faculty members were also examined by Panda & Mishra (2007) in a Mega Open University study of barriers impeding adoption and use. It was confirmed that high computer usage was directly related to positive attitudes toward e-learning. The researchers also discovered that lack of training in e-learning ranked among the top barriers to use and adoption, indicating that organized training and regular use of technologies were vital.

Mahdizadeh, Biemans, & Mulder (2008) investigated determining factors in the use of e-learning systems by university faculty. They found that the use of e-learning systems was directly related to faculty perceptions of added value which were directly influenced by faculty opinions of Web-based activities and computer assisted learning.

This supported prior research (Brett & Nagra, 2005; Lowerison, Sclater, Schmid, & Abrami, 2006) on how students engaged in learning tasks and their environment. Their study emphasized the importance of focusing on the teacher and student's learning approach before considering the impact of a particular technology in education. Sahin (2008) conducted a study that used a model based on the Social-Cognitive Career Theory to test the influence of its faculty members' self-efficacy in outcome expectations and interest on their intentions to use educational technology. The results showed that self-efficacy played an important role in increasing outcome expectations and interest in educational technology.

Professional Development

Supporting and encouraging the adoption of technology by faculty members is not simply a matter of convincing faculty of the benefits of technology. Rather, this is a complex process that encompasses training, education, and providing tools to develop the self-efficacy of faculty members (Compeau, Higgins, & Huff, 1999; Gunter, & Gunter, 2010). Daily (2000) and Sitze (2000) cited the need for faculty and student training to encourage use of technologies. Groves and Zemel (2000) reported that in order to use technology in teaching, users wanted accessible hardware, training, and discipline specific media that are easy to use.

Sheldon and Jones (1996) identified four critical factors in the integration of technology into the school curriculum: (a) time, (b) training, (c) technology, and (d) teacher-type tasks. In their 2002 study conducted in a medium-sized private institution in

the northeastern United States over a period of two years, Schrum, Skeele, & Grant (2002) concurred that there was a need for continuous technology training appropriate for each person, infusion of technology through multiple authentic applications, and the benefit of faculty incentives to foster commitment to change. Researchers have identified the need for continuous technology training appropriate for each individual's need that affords opportunities for application of learned skills.

Sahin & Thompson (2007) conducted a study using the Learning/Adoption Trajectory model to determine whether a midwestern university's college of education faculty level of technology adoption could be predicted by: demographics, computer experience, instructional hardware, or methods of learning about technology. The use of self-directed informational sources, collegial interaction, and the use of data analysis tools were found to be significant predictors of the technology adoption level of faculty.

LeBaron & McFadden's (2008) case study on the pressures of a university's school leadership program department to create online scholarship opportunities for professional educators broadened the spectrum of interest beyond pre-service and in-service teachers. They highlighted the need for ongoing faculty training and support to promote institutional change in their concern for the professional development in technology of pre-service administrators.

General Education

In order for faculty members to use instructional technology, they must find a sense of convenience and advantage in using the tools available to them (Dusick, 1998:

Mitchell & Gunter, 2004; Reznich, 1997; Spotts, 1999). In addition to their perceptions of student preference, teachers are influenced by their own levels of confidence and their participation in decisions as to the type of technology to use in the classroom (Grasha & Yangarber-Hicks, 2000).

Brill and Galloway's (2007) study on attitudes toward and usage of classroom-based teaching technologies at a large public university in the United States provided an interesting lens into the use of technology. These researchers found that though instructors showed great interest in newer technologies, they "currently rely most heavily on a few relatively low-end and well-established technologies: the overhead projector, VCR and the slide projector" (p. 99). These findings seem to be in accord with those of Peluchette & Rust (2005), where the technologies reported to be preferred by faculty members were generally considered "low tech" (e.g., transparencies, PowerPoint, chalkboard, and whiteboard).

In this chapter, some of the models that have been used to explain technology acceptance have been explained, i.e., Rogers' Diffusion of Innovations, Fishbein & Ajzen's Theory of Reasoned Action, Davis' Technology Acceptance Model, and Wedman & Diggs Technology Learning Cycle. Discussed were the models and their components. Also presented was the work of Moore (2002) as an example of Rogers Diffusion of Innovations and how the ideas presented complemented Gladwell's (2000) who explained how social epidemics take place and how three agents of change could affect the spread of a social or technological epidemic. Rogers' work was included as it emphasized the the influence a community has in the process of diffusion. Also reviewed

was literature concerning professional development, general education, and attitudes as predictors of usage that helped frame this study. The influence of the community, norms and conventions, professional development and the culture of an environment are all important as they are the foundation of Cultural-Historical Activity Theory, which is discussed in Chapter 3. Developing technology training has been difficult because of different levels of faculty interest, levels of individual autonomy and technology expertise (Howland & Wegman, 2004). Barriers for the use of technology in education have been identified as lack of teacher time, limited access, cost of the technology, lack of vision and planning, lack of support, consistency between teaching and learning styles, leadership of faculty chairs, lack of self-efficacy development (Alghazo, 2006; Bates, 2000; Berge, 1998; Berge & Mrozowski, 1999; Compeau, Higgins, & Huff, 1999; Newton, 2003; Rice & Miller, 2001; Shelly, Cashman, Gunter & Gunter, 2007; Shelly, Gunter, & Gunter, 2010). Most of the studies were conducted using the Technology Acceptance Model or another competing model. Chapter 3 provides insight into Cultural-Historical Activity Theory and how it may provide a better explanatory power in regard to technology adoption.

CHAPTER 3
CULTURAL-HISTORICAL ACTIVITY THEORY

Introduction

This chapter describes the Cultural-Historical Activity Theory (CHAT) framework which provided the theoretical basis for the present study. In this chapter, the researcher has provided an overview of CHAT using references selected for their value in illustrating and explaining the model in a clear and concise manner. Understanding this model is essential to understanding the data analysis and results presented in the latter chapters. This chapter is intended to serve as an introduction to benefit the reader rather than an exhaustive literature review. A definitive and thorough review of CHAT by Roth and Lee (2007) is included in Appendix A.

Cultural-Historical Activity Theory (CHAT), with origins in the Soviet psychology movement and based on the work of Engeström, examined an activity system consisting of an actor, the object upon which an action is performed, the community within which the activity is embedded, and the way tools mediate the action to create a theory of expansive learning (Engeström, 1987). Activity theory was originally based on Vygotsky's (1978) observations that the problem with psychological investigations was that experimental research was conducted separate from the context of human lives. This tradition of treating the organism and environment as separate entities created a new perspective (Cole, 1985). In the first generation of activity theory centered on Vygotsky's (1978) work, a new triangular perspective developed around the relationship between the object of cognition, the active subject, and the tool or instrument that mediated the

interaction. Vygotsky (1978) insisted that the tool is what mediated all psychological activity. This triangular representation of mediated activity is depicted in Figure 8.

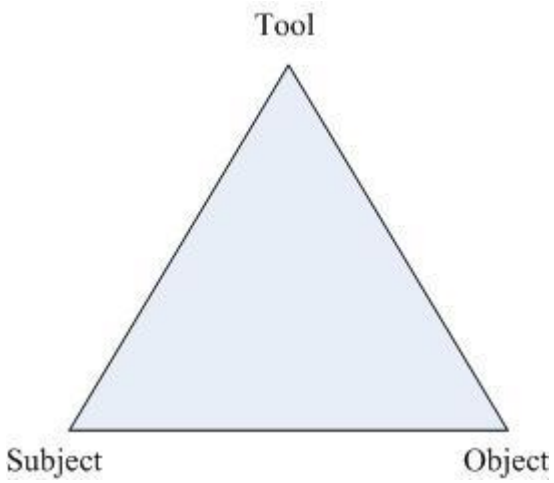

Figure 8. The basic schematic of mediated activity as developed by Vygotsky (1978, 1987).
Reprinted by permission of the publisher from Mind in Society: Development of Higher Psychological Processes by L.S. Vygotsky, edited by Michael Cole, Vera John-Steiner, Sylvia Scribner, and Ellen Souberman, p. 54, Cambridge, Mass.: Harvard University Press, Copyright © 1978 by the President and Fellows of Harvard College.

In Figure 8, the subject refers to the individual or individuals whose agency is selected as the analytical point of view (Hasu & Engeström, 2000). The object refers to the goals toward which the activity is directed. Tools mediate the interaction between subject and object. Vygotsky (1978) proposed the Zone of Proximal Development (ZPD) as the distance between what individuals can do by themselves and what they can accomplish when guided by more capable peers. The idea within ZPD is that humans

learn through social interaction, and this interaction takes place in a historical context imbued with cultural artifacts. This concept of mediated activity sees the learner as actively constructing meaning within a cultural-historical context. Vygotsky's model had several shortcomings that Leont'ev (1974, 1978, 1981, 1989) addressed by emphasizing the object's place in the concept of activity.

Leont'ev's work became the basis for the second generation of activity theory. The key in Leont'ev's writings was to emphasize the importance of the object as opposed to the subject and to differentiate between an immediate action and the larger overall system. Leont'ev proposed three levels--operation, action, and activity. Operations were the most basic of the three levels. Actions were associated with an individual's knowledge and skills. At the highest level was activity which was defined at the level of motives and goals (Gilbert, 1999). The motivation of an activity was to transform the object into an outcome. Leont'ev never graphically expanded Vygotsky's original model into a model of a collective activity system. Leont'ev's work began the process of situating activity within a larger system which was key in Engeström's subsequent work.

Engeström's (1987) work further contextualized the unit of activity by providing a triangular schematic for the structure of activity. The basic schematic of an activity system as developed by Engeström (1987) is displayed in Figure 9.

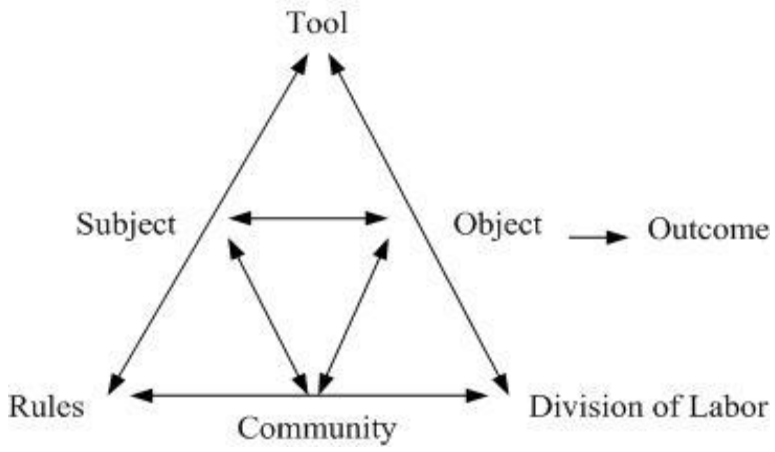

Figure 9. The basic schematic of an activity system as developed by Engeström (1987). Adapted from *Learning by expanding. An activity-theoretical approach to developmental research* by Y. Engeström, 1987, p. 78, Orienta-Konsultit, Helsinki.

The model entails a subject (individual or group) oriented to transform some object (outward goal, concrete purpose) using a culturally historically constructed tool (material or psychological). What Engeström added to the model were the components of community (the organization) and outcome (the intended or not implications of an activity). Furthermore, the subject relates to the community via rules (norms and conventions), and the community relates to the object via division of labor (organization of processes related to the goal) and to the subject via rules (Rochelle, 1998). This bottom part of the schematic is the one that acknowledges the contextualized nature of an activity.

Simply put, the Cultural-Historical Activity Theory framework is represented by a series of embedded triangles. The three sides of the outermost triangle represent a subject acting on an object while embedded in a cultural community. There is interaction

between the nodes; therefore, tools can mediate a subject's action on an object. Interactions between a subject and an established community are governed by established rules and customs. A community interacts with an object or objects through the division of labor. All of these interactions are driven by a planned or anticipated outcome or purpose.

Before applying the CHAT model to an activity system, a "unit of analysis" must be selected. This determines the scope and breadth of the activity under study. Fiedler (2006) discussed about using a flashlight metaphor to illustrate the unit of analysis. Activity-theoretical researchers can shine a flashlight on a system of interest. The width of the flashlight beam can be modified somewhat to determine the scope of the examination. It can be directed to various parts of the system, held at a distance to get a broad view, or held close to get a specific area. An example of a differing degree of scope was provided by Holt & Morris' (1993) analysis of the Challenger disaster. The CHAT framework was useful in analyzing the contradictions and double binds, seeing the actors perform in the system and witness the system moving through its various stages.

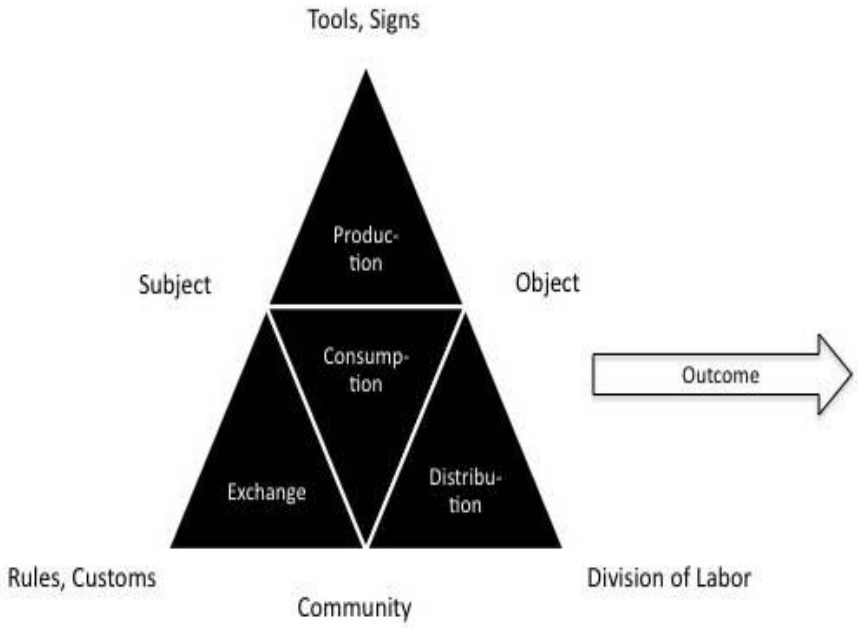

Figure 10. Engeström's Cultural-Historical Activity Theory model.
Adapted from *Learning by expanding. An activity-theoretical approach to developmental research* by Y. Engeström, 1987, p. 78, Orienta-Konsultit, Helsinki.

Figure 10 presents a detailed view of an activity system. By examining the nodes of the triangle in a more meticulous manner, one can better understand the complexities associated with the system. The *subject* of a CHAT analysis can be an individual or a group of individuals looking to fulfill goals through action (if individual) or activity (if group). The choice of the subject determines the perspective of the analysis. A subject acts on an *object*, a "modifiable end toward which activity is directed and from which outcome is expected" (Holt & Morris, 1993, p. 98).

An object can be a problem that needs attention or a concept one must learn. The object is integral to the activity, distinguishing it from another activity while carrying the purpose for it as a whole. Tools are means that mediate the subject's activity toward the object. Mediating tools include artifacts, signs, language, symbols, and others. Language, including non-word items like signs, are the most critical psychological tools through which people can communicate, interact, experience, and construct reality (Barab, Evans, & Baek, 1999). The "community" can be defined as a group of individuals who share a set of social meanings. "Rules" are incomplete guides for action dictated by the community. The "division of labor" entails the completion of specialized tasks by members of the community. These nodes form the outermost or primary triangle.

Inside this outermost triangle are four smaller triangles, labeled in Figure 10 as "production", "consumption", "exchange", and "distribution." These terms are used to represent the higher order functions taking place as a result of the interactions between the nodes of the sub-triangles. Engeström relied on Marx's (1973) definitions of the terms to explain their meaning:

> Production creates the objects which correspond to given needs; distribution divides them up according to social laws; exchange further parcels out the already divided shares in accord with individual needs; and finally, in consumption, the product steps outside the social movement and becomes a direct object and servant of individual need, and satisfies in being consumed. (Marx, 1973, p. 89)

One important aspect to note is the paradox contained within the activity system. Though the total activity is geared toward production, its sub-triangles produce and consume simultaneously. This assists in the overall production of the system. In order to produce in an activity system, energy is required in the form of things that are produced.

These things must be produced so they can be consumed and energy produced. This, in turn, aids the outcome of production. Thus, activity systems are driven and exist solely because consumption necessitates production and vice versa.

The following example is an invented vignette that creates a scenario in which the Cultural-Historical Activity Theory model can be applied:

David is a student at a large urban university in the southeastern United States. He has made many friends during his time at the university. He recently completed all of his coursework and is currently working on his dissertation. David must update and submit his Electronic Thesis Dissertation (ETD) manuscript for revision according to guidelines received from the Department of Student Affairs at his college. It's Wednesday, and he is meeting his friends after work to catch up and support each other throughout their dissertation phase. The conversation shifts from family to dissertation, and to the editorial revision process all manuscripts must go through. All of the friends are also at the same stage. David admits to having challenges and being frustrated in getting the correct formatting for the ETD process. He tells the group that in his last feedback from his adviser, he received comments on the inconsistency in formatting in some parts of the document. Now, he needs to edit the document for style consistency and has not figured out how to do so without having to retype all of the text. Fortunately, his friend Chrissy has done this several times and offers to meet David at the library computer lab to show him how to do this. They agree on meeting the following Monday after work.

For the unit of analysis of this vignette, one can use one individual's activity or broaden the scope to examine activities of students as they complete their ETD. For this

illustration, David's activities, as he works on his Electronic Thesis Dissertation (ETD), can be analyzed.

David, (the subject) intends to work on his ETD to pass the editing review process (one of several possible outcomes). To achieve this outcome, he uses a printout from the Student Affairs webpage detailing the ETD process requirements (tool), his computer (tool), and word processor (tool) to correct inaccuracies within his ETD document. Chrissy (a member of David's community, but serving as a tool) helps him with his ETD editing (division of labor) because she agreed (rules, customs) she would do so when the friends (community) met as they usually do every Wednesday for support (rules, customs). The work that David and Chrissy do together is an example of horizontal division of labor because they both have equal status. However, Student Affairs has provided a handout to help David with his task. This is an example of vertical division of labor.

Tools and Objects

The above vignette provides an example of the way in which an activity system can be analyzed using the terminology associated with the CHAT framework. The use of tools was essential and a central theme of this dissertation. The purpose of this study was to offer *insight(s) into the technologies faculty adopt and their reasons for doing so*. This, in turn, provided an opportunity to examine the role of technologies (tools) and how they mediated the subject's activity toward an object. Examining the activity system using

CHAT was intended to provide a richer set of data than that obtained using traditional methods which did not treat technology adoption in a holistic manner.

Networks of Activity

As a result of activity theory's exposure in international arenas, questions of diversity and dialogue between different traditions or perspectives became increasingly serious challenges. While the first and second generation activity theory do not address these issues, third generation activity theory rose to the challenge of overcoming limitations faced by its predecessor in dealing with cultural diversity. Other challenges faced by third generation activity theory dealt with (a) understanding dialogue, (b) multiple perspectives and voices, and (c) networks of interacting activity systems.

Third generation activity theory has supported the concept that all activity systems are part of a network of activity systems. The CHAT framework displayed in Figure 11 depicts the networked nature of the activity and introduces the concept of boundary objects. It provides a visual representation of how an activity system can unfold into two or more systems.

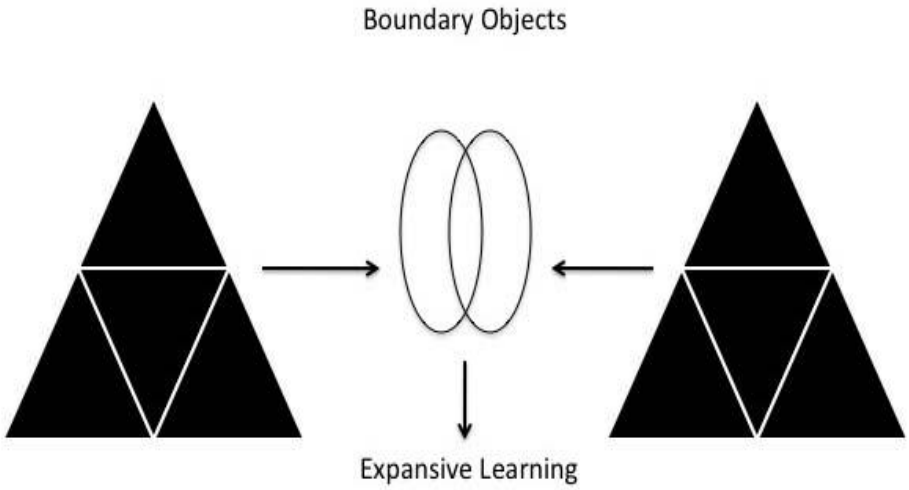

Figure 11. An example of a network of activity systems.
Adapted from University of Helsinki, Center for Activity Theory and Developmental work Research (2004). Retrieved from http://www.edu.helsinki.fi/activity/pages/chatanddwr/chat/

In this example, boundary objects are those that operate at the interface of many contexts (Edwards, 2005). Where two or more activity systems interact, there may be contradictions and tensions which offer opportunities for expansive learning. Russell (2002) and Chekland and Poultier (2010) suggested that *learning beyond what was thought to be possible within a single activity system becomes possible if practitioners engage in discussion, debate and reflection*.

Contradictions in an Activity System

The manifestation of the tension between production and consumption results from contradictions within and among the components of an activity system, between other systems, or between a system and a more advanced version of itself (Holt & Morris,

1993, p.98). This tension can occur when there is a need that has been unable to be satisfied by the current form of production (Blin & Munro, 2008). Such needs for the system to change create "need states" that Engeström (1987) believes are inevitable.

These changes to meet needs arise from four types of contradictions: *primary* (within each component of the activity); *secondary* (between the components of the activity); *tertiary* (between the activity itself and a culturally more advanced form of the activity); and *quaternary* (between the central activity and neighboring activities) (Engeström, 1987, p. 89). Using the previous vignette example of David, one can examine his activities as he is completing his ETD:

The university has instituted a new multimedia submission process for ETD. Since the program has been instituted this semester, David's advisor asks him to submit his multimedia files as part of the dissertation. David discovers that there is a limit on size of attachments, and his files are too large to be emailed from his email account to the dissertation editor at the university. This is an example of a secondary tension. Frustrated, David decides to use his Google mail account to email the ETD to the editor at the university but soon finds out that the server is timing out because the files are too large and the file transfer times out. This is an example of a quaternary tension between one system (Google mail account) and another (the university's email system).

In the example Holt and Morris (1993) provided of the Challenger disaster, several primary tensions were identified. One was the conflict in the Community node regarding the status of the shuttle program between being defense-dependent or self-sustainable. When the tensions occur between nodes in the activity system, it is called a

double bind. Engström (1987) referred to these as secondary tensions and identified several secondary tensions using the example of the Challenger disaster. One was between the decision makers who were not only trying to put safety first, but were trying to adhere to an aggressive flight schedule and the community node who struggled between making the shuttle program defense-based or being self-sustainable. The third level of tension occurs between one activity system and a more advanced one. The Challenger examples provides a more advanced set that prohibited cost-cutting at the risk of safety. The quaternary layer of tension was not addressed by Holt and Morris (1993), as they chose not to make it part of their work.

Changes in an Activity System

Change is inevitable, particularly when need states are present. Additionally, actors within an activity system find new ways of doing things by incorporating ideas from other systems. Contradictions can be revealed during analysis, but are often manifested as trouble on an ongoing activity. Such trouble can lead to one of two courses of action: a change of goals as posited by Barab, Barnett, Yamagata-Lynch, Squire, & Keating (2002; Yamagata-Lynch & Haudenschild, 2009) or abandoning the technology introduced (Russell & Schneiderheinze, 2005). Otherwise, this trouble can cause the creation of "workarounds" where the subjects can perform actions in unintended ways but nevertheless circumvent the problem (Bannon, 2011; Bannon & Bodker, 1991).

Summary

In summary, Cultural-Historical Activity Theory deals with human activities as they relate to tools, shared practices and institutions, going beyond individual knowledge and decision making to take a developmental view of minds in context. When people play, think, solve problems, or take part of in an activity together, they demonstrate an accumulated set of habits and values. Learning is situated within time and space--influenced by the surrounding actors, resources and behavioral constraints instead of being characterized as an isolated act.

The CHAT framework provides a useful analytic means to examine the technology choices of faculty. It provides the freedom and breadth for a researcher to look at technology choices as the minimum unit.

As with other complex, social phenomena, choosing technology comes with a history and culture. The tools available for faculty to use in their teaching and learning have multiplied exponentially. These changes mirror the changes in broader society as a result of globalization. Examination of the technology selection experience benefits from the use of a rich and robust framework in order to make a contribution to the body of literature on technology adoption.

CHAPTER 4
RESEARCH METHODS

Introduction

This chapter describes the research design and procedures used in this study. Included are descriptions of the study population, site and faculty selection, participant selection, data collection and analysis, and ethical considerations to be taken into account in this study.

Design of the Study

This qualitative research design, which employed qualitative inquiry research, was designed around the researcher's role as an observer. The use of interviews and document analysis as the educational media selection choices in a department of a college at the University of Central Florida were explored. The population was the faculty of the department.

The following research questions were formulated to guide the study:

1. Why do faculty members in higher education make the instructional choices they do with respect to educational technologies and media?
2. How can the use of CHAT, as a more robust framework, offer an increase in explanatory power to better enable the understanding of a multitude of factors that impact the adoption and use of certain media technologies?

Overall Approach to Study

Rossman and Rallis (1999) have affirmed that qualitative research is a broad approach to the study of social phenomena. They reported that despite the various methodologies within qualitative research, most qualitative researchers "are intrigued by the complexity of social interactions expressed in daily life and by the meanings that the participants themselves attribute to these interactions. These interests take researchers into natural settings, rather than laboratories, and foster pragmatism in using multiple methods for exploring a topic " (Rossman & Rallis, p. 2). Thus, qualitative research is grounded in the lived experiences of individuals.

Qualitative research is "(a) naturalistic, (b) draws on multiple methods that respect the humanity of participants in the study, (c) focuses on the context, (d) is emergent and evolving, and (e) is fundamentally interpretive." (Rossman & Rallis, 1999, p. 2). Additionally, Fiedler (2006) posited that "most Cultural Historical Activity Theory (CHAT) research is conducted using qualitative approaches because these methods enable researchers to examine the social system in which the focus of research is embedded which is a critically important aspect of the CHAT framework" (p. 67). This was affirmed by other researchers' notions of context-situated research (Alvesson, 2010; Holloway, 2009)

The purpose of this study was to understand the choices that faculty members in higher education made with respect to educational technologies and media. Qualitative research methods were appropriate for this task.

Determining the Specific Research Approach

Many researchers (Atkinson, Delamont, & Hammersley, 1988; Denzin & Lincoln, 1994; Jacob, 1987) have posited the creation of genres within qualitative research. Gall, Borg, and Gall (1996) analyzed this multitude of approaches into three major genres: (a) an individual's lived experience, (b) society and culture, and (c) language and communication. Each of these major categories has one or more associated genres reflecting different methodological approaches.

The first broad approach suggested by Gall, Gall, and Borg (2006) was on an individual‘s lived experience. Phenomenological studies have been widely known and focus on the investigation of the lived experiences of a small number of people. Researchers have focused in depth on the meaning of a particular aspect of experience. They have assumed that, through dialogue and reflection, the meaning of the experience will be revealed. A phenomenological study on technology selection task might concentrate on a faculty member's experience in balancing the technology selection with competing priorities of class size, departmental demands, and work.

The second broad genre suggested by Gall et al. (2006) was a focus on society and culture. Ethnographic studies fit this type of research. The concept of culture has been central to ethnographers. Ethnographers study cultural groups through observation over a long-term period. Technology adoption research that focuses on society and culture can examine power relationships in the phenomena and policies that shape the process. The case study is an example of a genre that focuses on society and culture.

The final focus of Gall et al. (2006) broad approach was focused on language and communication. Studies conducted with this focus have relied on the analysis of speech and other behavior. Data for these analyses can include transcriptions and writing. These approaches, guided by research questions, can help an individual focus the inquiry by suggesting data collection models that are appropriate.

For this research, the researcher needed to choose a strategy that permitted a focus on the cultural context at the institution to answer his research question. Yin (1994) defined a case study as "an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident (p. 13). According to Stake (1995), a case study is likely to highlight previously unknown relationships and variables, leading to the development of a re-thinking of the phenomenon for the researcher as well as the readers. Other considerations, in making this determination, included whether or not the strategy was within the researcher's skill set and accessibility. A single site case study allowed interaction with the individuals while embedded in their social context and offered a glimpse into the cultural aspects of technology selection within their department.

Sites and Participant Selection

Having determined that a single site case study was an appropriate method to answer the research questions for this study, the researcher's efforts shifted to the selection of the site where the observations would take place. Rossman and Rallis (2003)

described, as ideal, a site where "entry is possible" (p. 136) which contains a "rich mix of the processes, people, programs, interactions, and structures of interest" (p. 136); one where "strong relations with participants" (p. 136) can be built; and devoid of overpowering "ethical and political considerations" (p. 136).

For the purposes of this study a department in a college at the University of Central Florida served as the case study site. The department offered an extensive array of courses during the summer semester and was environmentally rich in the use of technology.

The human subjects research took take place at facilities owned by the University of Central Florida (UCF). Interviews were conducted with faculty in (a) offices within the department, (b) the classrooms (online and face-to-face) at the department, or (c) a place of the faculty member's choosing. This proposal was subjected to the required review university process and was approved to be conducted by the UCF's Institutional Review Board (Appendix B). Initial permission to conduct the research study was approved and secured at the department chair level.

Resources Available to Conduct the Study

Recruitment was conducted over a two-week period ranging from mid-April to May, 2010. The time devoted to conduct the research consisted of 30 hours per week for interviews and observations over a one-month period during the summer term in 2010. Because the study was conducted solely by the researcher, no additional staff were involved. Similarly, because the research was conducted in faculty members' offices and

classrooms on the University of Central Florida's main campus, no additional physical resources were required. There was no anticipated need for medical and psychological services; however, if the need arose, participants could have been referred to the University of Central Florida Counseling Center.

Researcher Reflexivity

Prior to the interviews, the researcher completed a full description of his own experiences as a student and as a teacher to reveal his own personal assumptions about adoption of technology in teaching and learning. This aided the researcher in the recognition of his personal assumptions and/or biases during the research process. It was assumed that participants in the study would respond honestly in the interviews; their only motivation for participating in the study was assumed to be their interest in contributing to the growing body of research on adoption and usage of technology.

Before proceeding any further into the succeeding chapters of this study, it is vital that the researcher exposes how he selected this topic for his dissertation. Those that are familiar with qualitative methods know this act of disclosure under a variety of names such as reflexivity, transparency, or self-disclosure, among others. It is a term used to describe "the importance of self-awareness, political/cultural consciousness, and ownership of one's perspective" (Patton, 2002, p. 64.) I have chosen to call it Personal Reflexivity. For readers who are unaccustomed to such act of personal disclosures, this may seem strange. Hence , I begin with theoretical support and an explanation for this act of self-disclosure.

Rossman and Rallis (2003) have urged qualitative researchers to reflect on role and purpose prior to data collection but have also cautioned researchers to "be themselves." Additionally, they have offered personal perspectives on what "be themselves" means:

> For us, being ourselves means that we have articulated our perspectives or frames of reference toward the topic–that is, we know our beliefs and values and our assumptions and biases relative to that topic. We are clear about our theoretical and methodological orientation: we consider past experiences that might influence our views. In short, we try to be aware of and vigilant about the baggage we carry into the inquiry (Rossman & Rallis, 2003, p. 51).

Delamont (2002) also has reminded qualitative researchers to "be constantly self-conscious about their role, interactions, and theoretical and empirical material as it accumulates. As long as qualitative researchers are reflexive in making all their purposes explicit, then issues of reliability and validity are served" (p. 9). These suggestions help the researcher prepare for biases that may affect the research. For these reasons, I wrote about how I became interested in researching technology adoption, my personal experiences with technology as a student, a teacher, and as an individual providing technical support to faculty.

But why disclose this information to the reader? Some writers (Punch, 1998; Strauss & Corbin, 1998) speak of the "researcher as instrument." Although quantitative researchers often use instruments that have been scrutinized for validity and reliability, qualitative researchers depend on their own observations and perceptions in a unique field situation to collect, analyze, and report data.

The importance of this act of reflexivity is very obvious: "A researcher's background and position will affect what they choose to investigate, the angle of

investigation, the methods judged most adequate for this purpose, the findings considered most appropriate, and the framing and communication of conclusions" (Malterud, 2001, pp. 483-484).

Experiences with Educational Technology as a Student

Growing up in an inner-city setting (New York City), I did not come into contact with a computer until I was in middle school. Most of my learning had taken place with the teacher being a lecturer and students taking mostly a passive role in the process. Most students in the school did not have a year-long computer class. Rather, we went to the computer lab for a period of three weeks three times during a school year. Most of the students were not excited about using technology, and I wondered why that happened. Now that I consider it further, the teacher was not excited either and looked as if he did not want to be there. He spent the first two classes giving us the "rules." Our actual use of the Commodore 64s available in the laboratory was very controlled, and little exploration was permitted. Instead the teacher made us perform drills. We did not learn to use technology as a result of having another educational objective or goal in mind. Learning computers was the goal. This may have contributed to the students' lack of interest in being in that particular classroom.

Experiences with Educational Technology as a Teacher

Going back to teach in the school I attended made me realize that most of my peers had not changed their educational practices. I was amazed at how many of my

colleagues did not take advantage of using technology to spark the interest of their students. After a few years of teaching in a self-contained classroom, I had the opportunity to become the technology coordinator for my school, and I was able to see some of the advantages of technology used properly as a tool to improve teaching.

As an example, one of the teachers had complained about a problem student I will call "George" who was labeled as a typical class problem. After having a few challenges trying to get him to work in my laboratory, I realized that George became bored very easily. He also did not have the best handwriting, and he was aware of it. The mechanics of writing were discouraging for him. With the aid of word processing software, some graphical organizers, some concrete learning objectives and motivation, George was producing more written work than any of the students in the class by the end of the semester. He made sure he did not miss his laboratory time. This is one example that shows how technology, when used properly, can serve its intended purpose as a tool and a motivator and enhance the learning experience.

Experiences with Educational Technology as a Support Specialist

In my experiences in the public school system and higher education, I have also seen reluctance displayed by faculty members when dealing with technology. This became apparent during my first year as the technology coordinator in my school. An experienced business person, "Mrs. Smith," had recently joined the faculty and struggled for most of the first year trying to understand computers and technology. She became increasingly testy and frustrated when I offered to help. I persisted, trying to explain that

I was there to help her learn ways to automate common tasks and enhance her teaching, freeing more of her time to help the students that needed her the most. It was possibly the longest year I experienced, but when I left the school, she gave me a card thanking me for the patience I had displayed in working with her. Mrs. Smith was the exception rather than the rule. All too often, educators do not tap into the potential benefits that technology can offer. Instead, they cling to old practices and methods which may not be as effective or relevant to present-day audiences.

Research Participants

To achieve the in-depth understanding of the phenomena associated with the aim of qualitative research, purposive sampling must be conducted. Participants, in this case were faculty members who were considered to be early adopters, chosen because they could provide useful and important information about the setting. Early adopters typically will find a way to integrate a tool into their teaching and learning tasks. This process can provide insight into the early adopters' experiences and illuminate the challenges they face. If those challenges can be identified and analyzed, the process can be simplified for other adopter groups to accelerate the adoption process. Often, technology decisions are made at the administrative level with little to no input from the individuals who will use the technology on a daily basis. Some of these choices may not be the best for teaching, learning, and student motivation to learn. A factor to be considered is the breadth and depth of the phenomenon under study. Rather than focusing on the quantity of information to be gathered, the research participant selection process was redirected to

ensure the richness and usefulness of information that the participants could provide in answering the research questions.

After receiving approval for the study from the Institutional Review Board (IRB) of the University of Central Florida, permission was secured from the department chair of the targeted department to recruit participants. The researcher received a list of faculty members who were teaching for the summer semester from the department chair. Once the list was reviewed, email and personal contact were the methods used to identify the participants. Faculty members were contacted via email and recruited using an informational flyer and a Summary of Research document (Appendix C).

After determining that three participants would be needed to complete the research, three faculty members were recruited. The only inclusion criteria for the participants were that (a) they were faculty members in the department at the University of Central Florida (b) they were teaching a course during the Summer 2010 term, and (c) they were considered early adopters of technology. Use of technology was self-reported by participants. The participants received a $20 Barnes & Noble gift card at the conclusion of the last interview.

One concern in the study was to ensure that excessive demands were not placed on the department taking part in the research study that might overextend its faculty members with other commitments. To that end, it was decided that Miles and Huberman's (1994) notion of data saturation would be applied. Data saturation occurs when the researcher no longer hears or sees new information. As a result, the researcher decided on a smaller sample size. A small sample size of three was selected because of

time limits and manageability. Additionally, three faculty members was an ideal sample size in that if someone withdrew from the project, the researcher could report on the remaining two participants. Because qualitative researchers analyze their data throughout their research, this is a realistic approach. In contrast, quantitative researchers must wait until they collect all of their data to analyze it.

Ethical Considerations

Qualitative researchers must reflect on the ethical implications before entering a research site (Marshall & Rossman, 1999; Patton, 2001). This process aids in creating an awareness of ethical issues that may arise during the fieldwork and is helpful in developing strategies for handling any dilemmas that may surface. Rossman and Rallis (2003) discussed three ethical issues they characterized as "generic to qualitative research" (p. 73): privacy and confidentiality; deception and consent; and trust and betrayal. These are explored in the following section.

Privacy and Confidentiality

The adoption and usage of technology is an important issue in most schools and universities in that they are faced with equipping students with the technical knowledge to become useful members of society. In the case of colleges and universities in the southeast, the National Council for Accreditation of Teacher Education (NCATE) also has adopted rigorous standards that describe appropriate integration and usage of technology at an institutional level.

Faculty confidentiality played an important part in this research study. The researcher would not have been able to gather faculty members' perceptions without their voices. Given faculty members' employed status with the university, it was deemed essential to protect their identities in the event that their revelations in interviews would not be positively viewed by administrators. The researcher was careful to maintain confidentiality regarding the institution and the identification of the faculty members who agreed to participate by permitting the researcher to visit their classes and be interviewed. It is of the upmost importance to stress that the department chair did not know who was selected to participate in the study and that the researcher did everything possible to make it challenging for the administrator to figure out the identity of the participants.

Trust and Betrayal

The researcher worried about the promise of confidentiality and the potential of a future ethical dilemma; however, there was no anticipation of any problems with respect to betrayal or trust. The concern was that the participants would refrain from doing the everyday things they normally do in the classroom because of the researcher's presence.

The other area that was of concern was arranging for departure from the research site. Having met for several hours with the participants, during which they had disclosed their feelings, attitudes, and experiences, the researcher did not want to leave hurriedly. The researcher speculated that the participants might think of themselves as being objects that had been used and all contact would be cut off once the data collection process occurred. The researcher settled for informing participants that contact would be

maintained via email during the subsequent data analysis time period and at the conclusion of the study to provide electronic copies of the researcher's final document.

Deception and Consent

In the world of research, informed consent is crucial. As Rossman and Rallis (2003) posited, "This means that the participants are not deceived about the study and their participation is voluntary" (p. 75). Another purpose of informed consent is to ensure the identity and privacy of the participants involved in one's research study. This research study did not seem to pose any questionable practices as none of the questions suggested deception and the study was dependent on the interaction and interviews between the researcher and participants.

As far as informed consent, the researcher determined from the department chair, the list of faculty members who were teaching during the summer semester. Once identified, the three faculty members were contacted by email and briefed in person about the research objectives. It should also be noted that since the prospective participants had received an informational overview beforehand, the researcher devoted most of the time talking about the aspects that were not addressed in the overview and answering any questions or concerns that the participants had.

Trustworthiness

Due to the fact the researcher was the primary instrument in this study, several conditions related to the research items needed to be clarified in order to avoid the

oversimplification of the research process. During the course of the study, the researcher recorded his experiences in collecting data in written detail. Furthermore, the researcher took a close interest as to how the concept of media technology choices evolved during the data collection process. Rossman and Rallis (2003) provided a rationale for the use of several strategies to ensure credibility and rigor. Three strategies employed in this research study were triangulation, prolonged engagement, community of practice and member checking.

Triangulation involved the use of researcher notes, reflective writings of the data collection process, the audio taping of the participant interviews, memos, and field notes. Additionally, triangulation documented the process and ensured that the complexity being observed was recorded in a thorough manner.

Prolonged engagement was accomplished by being present in the setting for a prolonged amount of time so as to "ensure that you have not studied only a fraction of the complexity that you seek to understand" (p. 69). Although more prolonged exposure would have been desirable, for the present study, 30 hours provided enough time to see some of the tensions within the system manifest.

Engaging in critical and engaged discussion with colleagues in a trusted setting employed the community of practice. This strategy was used to create a climate of sharing of emerging ideas, hypotheses and information relevant to the study. The researcher utilized Dr. Fiedler throughout the duration of the study as a critical friend, in order to discuss the emergence of the data, some of the early dilemmas that originated from the interviews, and the data collection and analysis process. This allowed the

researcher to reach a greater sense of clarity of the methods and strategies that would be beneficial to complete the study.

Finally, member checking involved going over the interview transcripts and sharing these with the participants. This has a twofold purpose: first, it prevents the identification of participants by their responses and secondly, it ensures that the interview excerpts accurately reflected the participant's view and that were not altered by the researcher.

Procedures Used

This research focused on a process of engaged interaction with participants with an open mind to the phenomena in order to examine their activity systems. In this process, researchers become the main research instruments as they ask questions and search for patterns that explain this phenomena, taking into account the experiences, attitudes, values, and perspectives of each of the research participants. The study design was based on a single site case study using interviews, observations, and document reviews.

Once the study was approved and participants recruited, classroom observations began. Observations were made during every face-to-face class session over a four-week period during the Summer 2010 term. Because each class session was three hours in duration and met once a week, the researcher was able to complete approximately 30 hours of classroom observations. The first interview occurred during the first week of observations. The data obtained from this research included field notes for class

observations and transcripts from interviews. The Observation/Field notes Summary Sheet is contained in Appendix D.

The volunteers participating in the study were asked to conduct class as they normally would in any regular classroom. The researcher observed participants while they took part in classroom activities during each class session throughout the four-week period and took notes on what he saw.

Participants were also asked to participate in interviews outside of class time. The interviews were held in locations most convenient for the participant. Faculty members were queried as to (a) how they used educational technologies and media and (b) their attitudes about the use of educational technologies and media. With the participants' permission, the researcher used a digital recorder to record dialogue from the interviews. The participants were always notified when the interview was being recorded, and the recorder was placed where the participant could see it.

Interviews

Richards (2005) described an interview as being ordinary or extraordinary. The first term refers to an "everyday" or routine quality. Extraordinary refers to the novel possibilities that can be used in interviewing to explore a person's experience.

Patton (2001) described four types of interviews: (a) informal, conversational interview, (b) interview guide approach, (c) standardized open-ended interview, and (d) closed, fixed response interview. In the informal conversational interview, questions arise from the context, in a dynamic manner, and are asked naturally as a result of the course

of the interview. There is no predetermined number of questions or content. In the interview guide approach, the topics and questions to be raised are created in advance; however, this is completed in an outline form, thus enabling the interviewer to select the words and language to be used. The standardized open-ended interview differs from the interview guide approach as the exact wording and content of the questions is specified in advance. The questions, however, are open ended. The last type of interview refers to the interview type where questions are determined and answers are fixed. In this type of interview, participants must select from fixed responses. The standardized open-ended interview was used in this study in order to increase the comparability of responses among those being interviewed. These questions served as the initial material to acquire background information on each of the subjects. Further interviews were conducted to follow-up and gather additional information. These interviews were dependent on the responses from initial interviews and classroom observations. The researcher's intent was to personalize the interview(s) for each individual as much as possible in hopes of gleaning relevant data that can prove useful for this research study. The interview protocols are presented in Appendix E.

All interviews were digitally recorded and transcribed to text. The transcriptions were subject to editing when necessary in order to enhance the clarity of meaning. The files were burned to optical media and saved in a locked cabinet until the dissertation project was completed. The files were imported into Audacity, an audio editing software package, to mask the sound of the participants' voices and ensure anonymity. This was essential to minimize any concern that the participants might have in regard to

jeopardizing their status or reputation by what they shared in the interviews. The resulting files were then imported into ATLAS.ti for processing. Atlas.ti is a software package that offers the greatest variety of tools for accomplishing all the tasks associated with a systematic approach to unstructured data, i.e., data that cannot be meaningfully analyzed by formal, statistical approaches (ATLAS.ti Scientific Software Development GmbH, 2011). It helps researchers explore the complex phenomena hidden in textual and multimedia data. It is a tightly integrated suite of tools that supports the analysis of written texts, audio, video, and graphic data. The integration of its tools is designed to support the workflow of the qualitative researcher. Hence, it provides the researcher with highly sophisticated tools to manage, extract, compare, explore, and reassemble meaningful segments of large amounts of data in flexible and creative, yet systematic ways. On occasions where notes were taken outside a classroom, they were recorded by the researcher using pen and paper and then recorded digitally as soon as possible to retain the essence of details and thoughts conveyed. These notes were also edited and then imported into Atlas.ti for analysis.

In regard to the number of interviews conducted, it was not the intent of the researcher to impose an artificial limit as to the number of interviews with participants. Rather, the researcher conducted interviews as often as deemed necessary or as a result of a finding in the classroom setting.

The data collected from both interviews and class observations were digitally saved on an encrypted computer drive, password protected, and was to be destroyed three years after the study was completed. In order to lessen the probability of risks, the

researcher used pseudonyms to lessen the likelihood of a breach of confidentiality. In addition, the recruitment methods used were designed to enhance anonymity. Finally, the interviews were conducted at locations selected by each faculty member.

Documents were obtained and reviewed using sources which included discussion board posts, course handouts, and PowerPoint presentations. There was no need to collect student data or school records as the focus of the research was on the faculty members and not the students. Audio recordings were used to facilitate accurate transcriptions as well as to ensure data integrity.

Data Collection and Analysis

Data management took place using Creswell's Data Analysis Spiral (1998; p. 142). In order to analyze qualitative data, the researcher engages in a process of moving in analytic circles rather than moving in a linear fashion. The concept is that a researcher enters with data of text and pictures and emerges with a narrative that tells a story.

Data Collection

In the first loop of the Creswell's Data Analysis Spiral (1998), called data management, the researcher begins the process. The researcher in this study organized the data being collected (field notes, observations, interviews, and document reviews) into different folders. These were then converted into electronic format either by transcription or entering the notes into a database for further analysis at some later time. The audio recordings were masked through the use of Audacity software once transcription took

place. Interview data was protected through the use of pseudonyms, so the participant's identity was protected. Also, member checking took place to prevent the identification of the participants by their responses and to ensure that the interview transcripts accurately reflected the participants' views. After the paper data were converted to electronic form, the paper forms were secured in a separate filing cabinet with a lock and were stored separately from other data.

Data Analysis

Analyzing collected data is an iterative process. Books, documents, and journal articles on technology adoption were examined to gather relevant information on technology adoption and usage models. The process of book, document, and journal article analysis helped in the development of a "start list" of codes, which were used in the data analysis phase in conjunction with the Atlas.ti software. The analysis phase was essential in order to look for ways to strengthen the validity of the study.

The data analysis process began with the transcription of all interviews. Once the interviews were transcribed to text, the transcripts were read to identify categories of responses. These categories were examined to ensure their alignment with the research questions. Once alignment was ensured, these categories were coded and entered into Atlas.ti for further processing and tallying. The researcher made use of Atlas.ti software to create a database that contained all the notes and data collected from the research study. The software provided the ability to create an organized storage file where the researcher easily located material.

Following the organization and conversion of the data, the researcher continued the analysis by immersing himself in the entire database of information, reading it several times over. This provided the researcher with a "big picture" of the data before being divided into smaller components (Agar, 1980). Reviewing memos in the field notes and transcripts was helpful during this phase, the reading and memoing loop of the spiral.

The next loop of the spiral consists of moving from reading and memoing to describing, classifying, and interpreting. In this phase of the loop, the researcher describes in detail, develops themes through a classification system and category formation, and describes extensively what is seen. In the classification phase in this study, the information collected was examined and recategorized in order to look for categories or themes. Initially the researcher was searching for five or six general themes, some of which could have subthemes of their own represented by some "parts" of the data collected. The preliminary coding instrument is contained in Appendix F. The goal in this phase was to reduce the data in order to produce "a small, manageable set of themes to write into the final narrative" (Creswell, 1998). Finally, interpretation consisted of making sense of the data as described by Lincoln and Guba (1985). The researcher established patterns and searched for correspondence between the categories. The researcher was able to form a larger meaning of what was happening in the site through the use of Cultural Historical Activity Theory (CHAT).

In the final phase of the spiral, the researcher presented the data, which consisted of a recollection of the findings in narrative form, augmented through the use of tables and figures. The researcher reported the events and the activities taking place. The

researcher also reported on the tensions discovered through the use of CHAT and described the different levels of tensions present in the activity system.

Observations

Consideration was given to the structure of interviews and what the observer would focus on during the classroom observations. The researcher made a decision to conduct observations in both laboratory and classroom settings. These observations allowed the researcher to glimpse at the interaction between the faculty and students, between the faculty member and the technology tools at their disposal, and how technology is used as a tool to support teaching and learning objectives.

Document Review

Reviewing material culture is another of the methods that Rossman and Rallis alluded to in their discussion of gathering qualitative data (2003, p. 139). The purpose behind analyzing documents, according to these authors, is that it provides an alternative way in which to understand the context of a research setting. The researcher in this study reviewed the documents (objects) that were created in class by the participants, i.e., slides, podcasts, as part of his analysis of the faculty members' activity system, specifically the interaction between the subject and the object through the use of mediating tools. The Document Analysis Summary Form is contained in Appendix G, and all of the documents were saved in electronic format for later analysis.

Limitations of the Study

There were several limitations to this research study. First, the sample was limited to faculty in one curriculum specific department at a university. The three participants were chosen because they were considered early adopters and relied heavily on technology to aid them in their teaching and learning tasks. As such, the results of the study were unlikely to be widely generalizable. Also, it would have been advantageous to remain in the setting for a longer period of time in order to collect longitudinal data. However, for the purposes of research associated with a dissertation, the time period was limited to four weeks.

Summary

The methods and procedures used in this qualitative inquiry studied the choices in the selection of educational media by faculty members of a program in a higher education institution. The single site case study is designed around my role as an inside researcher in the site and the use of Engestrom's (1987) Cultural-Historical Activity Theory (CHAT) framework to examine the activity system faculty members take part of when selecting educational media for use in teaching and learning. Interviews, observations, and document reviews were used to gather data that is combined with the researcher field notes, and memos to ensure the richness and trustworthiness of the research study. As a qualitative study it highlights relationships and frames perceptions of the actors from the inside with the goal of gaining a systemic overview of the process in which faculty members take part in as they select educational media.

CHAPTER 5
ANALYSIS OF THE DATA

Introduction

This chapter describes the media selection-related events, observations, and conversations during the Summer 2010 semester at a department of a college at the University of Central Florida. Patton (2001) stressed the importance of providing description of context before beginning analysis, and this chapter offers the description necessary to begin the analysis. The separation into different chapters helps distinguish the matter-of-fact description from the subjective interpretation and analysis.

The narrative begins with a broad description of the institution, the department and the faculty members that participated in the study. This context helps the reader understand the larger picture of individual media selection at the department level and how it fits into the broader program. From there, the discussion is organized around the Cultural Historical Activity Theory (CHAT) framework. Specific details of events and discussions related to the CHAT framework are provided.

Population and Participant Overview

University of Central Florida

The University of Central Florida (UCF) is a large university located in the southeastern United States that is part of the State University System of Florida, the largest university in the state, and the second largest in the nation by enrollment

(University of Central Florida, 2010). The University of Central Florida was founded in 1963 as Florida Technological University. As it grew to encompass other disciplines, it was later renamed in 1978. At the time of the present study, the university offered over 225 separate degree options through 12 colleges and 11 satellite campuses throughout the state (University of Central Florida, 2011). As of Fall 2010, there were approximately 56,235 students enrolled and more than 10,152 faculty and staff employed (University of Central Florida, 2010). The 12 colleges were: Burnett Honors College, College of Business Administration, College of Education, College of Engineering and Computer Science, College of Graduate Studies, College of Health and Public Affairs, College of Medicine, College of Nursing, College of Optics and Photonics, Rosen College of Hospitality Management, College of Sciences, and College of Arts and Humanities. Currently, the university delivers its course content through four modalities: face-to-face instruction, over the Word Wide Web, reduced-seat time (a mix of classroom and online instruction), and video streaming, where the content is delivered over the web via streaming digital video.

The College Setting Under Study

The college under study was comprised of several academic departments that offered graduate degree programs in a variety of disciplines. In addition to these departments, the college offered graduate certificates in Cognitive Sciences, ESOL Endorsement K-12, Gender Studies, Professional Writing, and Teaching English as a

Foreign Language (TEFL). Collectively, the college offered over 75 graduate and undergraduate programs in 2011.

The Department Setting Under Study

At the initial stages of this dissertation research, the department under study was a separate entity within the college. In late 2010, the department re-emerged as a partnership between two departments within the university. As such, the department is now referred to under a new name although it remains under the umbrella of the same college. In addition to the degree programs offered by the individual departments, the new department offers several other programs in partnership with Valencia Community College and the University of Florida. As of Fall 2010, there were 4,489 undergraduate and 541 graduate students enrolled for a total of 5,030. Currently, the department delivers its course content through four modalities: face-to-face instruction, over the Word Wide Web, reduced-seat time (a mix of classroom and online instruction), and video streaming, where the content is delivered over the web via streaming digital video.

The researcher decided to select courses that were conducted in face-to-face modality because of the convenience of being present during the class and laboratory sessions and having the ability to observe the participants within their activity system. This is one advantage that face-to-face class sessions have over those conducted in the fully online or reduced-seat time modalities.

Saturating the CHAT Framework

In Chapter 3, the researcher used a flashlight metaphor to illustrate the focus that can be placed on a system of interest by activity-theoretical researchers. The width of the flashlight beam can be modified somewhat to determine the scope of the examination. It can be directed to various parts of the system, held at a distance for a broad view, or held close to highlight a specific area.

A challenge in writing about the CHAT framework is to take an intricate topic and divide it into smaller sections in order to present a narrative form that makes sense and tells a "story." When deciding on the scope of examination, it is obvious that great care must be taken in deciding on a strategy that allows a clear and detailed narrative which will contribute to the reader's understanding of the phenomena observed.

This chapter attempts to present the data in a linear fashion. Each of the participants and the complexity of the activity systems are introduced. Next, the nodes of the CHAT framework will be introduced and saturated with data collected. Each section contains highlights of some of the important similarities and differences in the findings regarding participants. At the conclusion of the chapter, a discussion of the production/consumption sub-systems of the activity system under study are presented. Since the focus of this study was the experience of faculty members when selecting educational media, the Subject node of the framework is the first discussed.

The Subjects

The research participants offered their personal perspectives including their teaching philosophies, expectations for their students, and education at the higher education level in general. To protect their identities, the researcher employed the use of pseudonyms selected by the individual participants. Unfortunately, the reduced summer program in the department constrained access to faculty members since most were teaching online classes or were engaged in research during the summer semester.

The sample consisted of three faculty members, two males, and one female as depicted in Table 4 :

Table 4

Participants in Study by Gender and Age Range

Male	Female	Age Range
2	1	30-59

These faculty members ranged in age from early thirties to late fifties, which was representative of the overall department faculty. This difference contributed little insight in terms of understanding the media selection activity at the department. Table 5 depicts the demographic information of the sample participants:

Table 5

Age Range and University Teaching Experience of Study Participants

Participant	Years Teaching at University Level
Agustine	8 years
Otter	5 years
Wolfe	8 years

Faculty members had an extensive range of technology skills. The volunteers who participated in this research were skilled technology users in the department who would be considered early adopters. This was an essential consideration as to why they were selected for the study. All of them had successful industry experience before becoming faculty. Their participation contributed insight into how the media selection experience for teaching and learning was affected by other factors.

The following sections introduce the participants in this study. Understanding the participants' concerns and knowing more about their media selection choices and trials offers useful insight for those reading this chapter. As a reminder, the use of pseudonyms and lack of specified gender or age was intentional in order to ensure the participant's anonymity.

Agustine

Agustine had been teaching at UCF for eight years first as an instructor and later as an assistant professor. Prior to teaching at UCF, Agustine was a television production

and digital media school teacher in a large urban school district in the southeastern United States. Agustine was a very dynamic individual who was involved with multiple research projects. Agustine had previously taught several courses in the department relating to digital video, digital media, interactive design and multimedia. Agustine was passionate about teaching and described what students should expect from him/her:

> . . . they (the students) are to expect someone who is going to give them full attention to what they are doing. They are to expect someone who expects the same from them, someone who is more interested in providing learning opportunities than grades, and someone who is usually passionate about the topic they are teaching.

This was the first time that Agustine has taught this course by himself/herself. He had co-taught the course twice before and had taught a comparable course in other departments. Agustine modified the course content to reflect more current thinking and be more production oriented, with an emphasis on the ramifications of what the software can do. Most of the course was taught using reflection so he/she could understand what students were learning. Agustine believes that the process of reflection is a powerful one which forces students to think about their metacognitive activity. Most of the activities were designed by the class for the following reasons:

> . . . Well, the fact is you're not a fire brigade, you can't put the fire out by yourself, you need help. [as a student] you want to learn that you probably should do things early and so if I give you three weeks to do a project somebody needs to put out a timeline together to have certain deliverables before then; otherwise if you work in a hurry in the end it's not going to work. So, the idea of deliverables, the idea of everybody taking a piece of the pie. . . Everyone does not have to do all the functions for a team to operate. For example, if someone is not very strong or has taken a course in teaching or technical, or someone is strong in programming, let them do the programming. If you're a graphic designer for example, I'll do the graphics or maybe you'll switch it out, get out of your comfort zone but the fact of the matter is that they can contribute. Or they can be a consultant, they don't

> necessarily need to do all the work. Another person who is learning, a newbie kind of person can be the one that can say: 'I'll tell you what, I'll listen to everything and I'll write the notes and organize the dates and stuff like that, but in the process you teach me how to do this as we go.' So that. . . usually the people that like to do the technical stuff don't like to organize and the people who don't like to do the technical stuff can offer something to the team by saying: 'I'll do all of that groundwork,' but they still should walk away learning some things from the process--and that really works! That's the way it works in business and industry too, by the way. People on a team everyone can do the job, people contribute what they can and everybody learns from it.

Group work is a theme continuously emerged in this study, especially since production was present throughout the interviews with Agustine and was reflected at the core of his/her pedagogical values. Agustine expressed his/her belief that this is a reflection of real world problem solving which requires individuals to work in groups and divide the labor in order to complete a task. Agustine also believes that working with others in a team and being accountable, has the potential to change the learning environment completely.

Agustine considered himself/herself comfortable with computers and technology. When discussing considerations in selecting media, he/she mentioned accessibility and availability:

> The other piece has to do with whether or not its available to me in the classroom. Not all the classrooms are wired the same and all that sort of thing. A lot of times, these technical situations, like not all the classrooms have the VGA cords, you have to remember sometimes to bring my own, I have to bring my laptop, and that's when everything starts, so it's not really a consistent thing you can count on.
>
> I have to make sure that the format is set up so it runs on both places. Some things you have to think it's crazy, but you have to think about because it's not standardized, ok? That's a big consideration but as far as the other stuff is concerned, the consideration is whether it's a viable thing and whether or not they can have, see it and hear and do what they need [to do] with it, and everything works well--the technology, the supporting technology. That's a big consideration.

An important point that Agustine made in discussing the media selection process. Agustine stressed the importance of the suitability of the media when it comes to the learning objectives:

> The biggest thing has to do with whether or not it makes the point. You know, is it valid? You may have a great video but if it doesn't speak to the point you're trying to make, um, visually and in some other way. . . . It has to be a supplement to me talking all the time. The big deal has to be that the students usually get tired of you know, no matter who it is--could be the best speaker in the world but after a while they listen to the same voice.

Two more themes arose from Agustine's interviews: the first was the emphasis throughout the interviews about using media as a tool to help achieve learning goals and "making the point." The second was about autonomy--or a faculty member's autonomy in choosing tools. In Agustine's particular case, as in the case with the other participants, there was a choice in the tools to be used. The department offered the departmental server. The university offered Blackboard as a tool to organize the content. Agustine chose to use WordPress. When asked about this, Agustine stated:

> I was reluctant to do Blackboard because I didn't want to lose control. One of the things about Blackboard--I'll give you a perfect example. Right now they have a wonderful system called Respondus which is basically. . . You can go in and upload your exams ahead of time and they'll convert them for you and put them up. But there is a 7 to 10 day lead-in time to do this, so basically what I have to do is write the exam off. I have to know 7 to 10 days before I want to do it and there are no assurances, no guarantees that actually it will be there 7 to 10 days from now. Well, if I do it myself, I put it in there and it's there now, you know, I can always work on my own schedule. A lot of times, people are pretty busy and they work on adjusting their time situation. You basically get this stuff done, like I have a workshop this afternoon and it won't be done until 10 minutes before the workshop and that's just the way time works, so the point is finding something for content management that I can control and not have to be: 'Ok, we're down on Tuesdays for four hours or whatever' doing maintenance or something between semesters. They [university dept in charge of maintaining Blackboard] have their needs and I have mine so I didn't find that convenient.

Thus, Agustine did not want to lose control of the system or have to depend on someone else's schedule in order to use these tools. The tools that he/she utilized could be adapted to his/her teaching needs as opposed to his/her adapting to the tools. And he/she can use these on his/her own terms. Agustine used WordPress because of the adaptability of the tool to meet his/her teaching needs and because it was included in the tools that he/she teaches his/her students to use:

> WordPress is one of several [tools]: there's WordPress, Drupal, and there's a couple of others out there. . . they're these. . . content management systems. I taught a course in content management and with that, WordPress was one of things that was a part of that course syllabus, to teach that. I said: 'Well, if I'm going to teach that I better use it.' What is nice about WordPress is you can actually [force] stuff together and make it what it was not supposed to be. It was supposed to be blogging software and can be turned to a real media-rich content management system with a nice interactive schedule and other things. It doesn't do all the things for educational use that it's supposed to, but it's enough and I actually got by. So, the answer was, it's basically based on something else I was doing that I already knew a little bit about, and we made it work and it gave me my independence to not have to worry about someone's schedule. That they [the university] have the right, the perfect right to do [to go down for scheduled maintenance]. I mean, they have the perfect right to be up and down whenever they want. I'm not going to criticize them for it. The point is, this is my schedule, not theirs.

Otter

Otter has been teaching at the UCF for two years as an instructor. Otter came to university life as a veteran with a15-year career in the field of 2D animation through the traditional Ink and Paint Department at a major entertainment company, hand inking and painting cels for theatrical productions and television. This granted Otter exposure to many areas of the production process and the ability to learn the nuances of the story and its visual development. Otter had a very soft-spoken manner and a very friendly

disposition, which was reflected, in the attitude toward students.

Otter was passionate about teaching and had a strong regard for respect and fairness in instructor-student interactions. Otter explained his/her attitudes regarding personal responsibility as it related to his/her teaching:

> Most students at this level know when they have not done their best. So I'm very direct with them. When you're not doing your best "I have to keep getting better" ah and a lot of them when approached directly they come back to you for a grade... um, that they want to be better but they understand that truly doesn't deserve to be better you just honestly speak to them and the fact that its all written down - you know my writing could be nebulous at times it is written down - and I do say what I expect. And the whole point of the critique is a constant reminder of the personal responsibility. Like today walking in and saying: "You know what day it is" because they knew what day it was when I told them last week: "When you come in back this is what you're going to have" so it is a constant bringing it back to their own personal responsibility.

Otter has made many changes to the course and in particular, introduced the concept of peer critiques. While it has had positive results in making students aware of deadlines and giving themselves room for creativity, it has also introduced some challenges. When someone other than Otter is teaching the lab section, there may be a difference of opinion over the focus of these and this is a source of frustration. As a workaround, Otter moved the critiques to lecture days so the students can get direct feedback.

The course is a production based course and as such, Otter makes sure that he/she maintains an engaging environment conducive to learning for the students. Otter has some very specific objectives for the students to achieve as a result of taking the class.

> They [students] should be able to analyze any visual information and be able to break it down into the critical aspects such as understanding why balance works, why depth of field work, why color works, what is trying to be said by using these different devices. There is a huge way that your brain is developed and there is a way that we understand things that is also culturally. And what I expect them to understand in the end is that your culture is not everyone's culture, your visual language is not everyone's visual language and when you look at the image, just think a little bit more. Think deeply about what it means, what message you're taking away from it. If you're getting the wrong message maybe the author didn't target you. Maybe you're not the audience. It's about understanding: Why?

In order to reach some of these objectives, Otter leverages his/her relationship with the students and makes himself/herself approachable without some of the more formal tones that are common to higher education. Otter thinks of himself/herself as a performer in order to reach students:

> I get up there and I will try to make them laugh. I will do silly , you know like, things like how I dress. I think how sometimes I wear silly shoes or …(pauses). I think you get there and you look for things in each person. You get there and you, if you know your stuff, you do your best to know your stuff. And if you don't know, don't say you know because then you look stupid, you know?

Otter's attitude would be considered rare in the academic circles where faculty members may consider disclosing to students their lack of particular knowledge to be a sign of weakness. This disclosure may make some faculty members uncomfortable because it may be perceived as creating a shift in the dynamics of the relationship and subsequent interactions between instructors and students.

Otter expressed strong feelings about student objectives in and out of the classroom. As this was a production-based course, Otter stressed how the knowledge applied in the course translates to real world situations and how the students can use that

to their advantage. This attitude can be attributed, in part, to Otter's industry experience prior to entering the education arena.

> I want them to understand that their voice is important--speak up because you have something good to add. And if, yeah, and this is my personal experience. I've worked in a large, commercial, um, animation studio and the people who speak up get recognized even if they aren't saying the brightest things. But if you don't talk, then you get completely bypassed. And for most folks entering the art world, there is a lot of competition out there. And if they don't learn to speak, one with the right language, the right tone that indicates that they have the understanding of visual language, they are not going to, you know, they're not going to progress in their field. They're going to be dismissed; they're going to be worker bees. And they all want to be creative, and they have to be empowered.

Otter's professional experience as an animator was only one part of the reason he/she felt this way. The other part has to do with the hardship he/she experienced and his/her beliefs in second chances. Otter explained his/her desire to teach:

> I always wanted to teach. I was a poor kid and I got through school on grants and small scholarships and worked full time and went to school full time. I was very fortunate that things wound up the way they did where I wound up in a really good paying job and was considered a successful artist. Things were hard, and I hustled and worked hard. And I want students to be exposed to someone who says: 'You can do it!' as opposed to: It's over now. You made this choice and you're done. You know, where I originally had thought I would go get my masters after getting my bachelors, I got a job and then got sidetracked by this career that helped me raise my children. But I went back to school and got my master's degree. And so that's why I do it, because I believe everybody deserves that opportunity.

According to Otter, the department does not offer any guidelines or suggestions other than in courses where specific software is being taught. When Otter designs content objectives he/she thinks of the media that is most appropriate to meet those objectives:

> "Um, It depends on what I'm trying to show. It depends on (like I was just saying) using just basic drawings and chalkboard (laughs) on one end of it and really the PowerPoint is a factor of just organizing my lecture. PowerPoint is really excellent for me to know how to organize my lecture, break it down into pertinent points, and then talk over the slides. It keeps me on good pace and [on course]. I like PowerPoint a lot. It is multiple layers of being able to communicate the idea.
>
> It seems to, to me its like such a simple'. . . to me it's such a simple decision because if I'm communicating a how-to in the program, then that's the obvious choice. And letting them. . . talking over them (the actions) saying: 'Here's this', 'Here's this', and 'Try this tool to do. . . ' you know, a direct demonstration. If we're talking lecture, then most definitely PowerPoint because of the concepts that you need to get across. So it depends on the context of what I'm talking about...
>
> A lot of it is student response and they respond. I, I started out my first semester doing a lot of lecture with fewer visual and sketches in PowerPoint and they were completely the students were 'This is so much information' you know. . . and by breaking it into slides and talking over the slides, it's the same amount of information but the bullet point of what they, the core message is up on the slide, uh, really helps them focus more on why I'm saying the things I'm saying.

When asked why he/she uses the departmental server in this course as opposed to the university sanctioned Blackboard, Otter expressed some frustration over the layout and logistics of Blackboard and the ease of use of finding the information that one needs:

> I tried to do Blackboard and it's not efficient at all. The way that they designed the program is not user friendly, its irritating, extremely irritating because its like: 'Where is the logical place for this?' And then they've changed like myUCF so that they know exactly where it is. The departmental server is public and that's why I use myUCF for the grades, but they've changed it, and they've integrated web course design into myUCF. It was so much simpler and straightforward before and I had to get on the phone with the help people and it was a little bit of a problem trying to find the help number. They don't immediately send you to the homepage. So, where are the help pages with the phone number, the first thing they send you to is the grades. So it's the logic of how it's built, it's not simple and straightforward. So that's why I would prefer not to use Blackboard. I find that the UCF is just not straightforward if you try to find a piece of information and then you search in the information window and it doesn't come up with what you're looking for. . . you know. . . the logic.
>
> The departmental server is convenient and everybody in my department is using it, so the students should have an understanding of how to use it. It is so much easier to post their assignments on the departmental server, and I have a

> core place to go and know when they posted it because it gives me a time and date and all that good stuff so its good tracking. And its accessible so they can look at other student's work.

A theme present in the conversations with Otter revolved around the conflict he/she experienced regarding his/her pedagogical values and his/her belief that department requirements put him/her in a place where these values become compromised. When asked about this, Otter explained:

> I worked much more than 40 hours a week. I spend a lot of late nights trying to keep the quality of the teaching up and the quality of the feedback up and if not to the level it was, say, when the class was 25 to 28 [students]. When my department head told me about this increase in class size, I immediately asked: 'How am I going to keep the quality of instruction?' and his response was: 'Do what you can do.' So they, the administration is well aware that they are taxing the basic time constraints and energy levels of their faculty. They're well aware. But they want more students, I guess they have cost demands that are really conflicting with the mission of the university, I feel. And so I personally feel conflicted because there is a certain level that I know that I am capable of and that most people that come through my class show a significant improvement in their ability to create, things that they create so I get, um, my grading has gotten slow, you know slower with the grading (laughs) you know because twice as many students take twice as much time, you know? And so, the students get frustrated because they need feedback and so I'm trying to, I am right now, struggling with how do I. . . I need to reduce feedback in order to get it on a timely manner but I haven't been able to force myself to say: 'That's it, that's all you get!'

Otter empathizes with the students and when further asked about the class size issues and the effects of that on the student cohort, he/she contemplated the response and indicated that it is normal during the course of a semester for a few students drop out of the course because they realize the amount of work they have to do: "They are overwhelmed or are intimidated by the workload or by other students."

Wolfe

Wolfe is the youngest of the three participants. Wolfe began his/her teaching career at UCF and has been teaching at the university level for eight years. Prior to teaching, Wolfe had extensive experience with technology, working as a programmer and analyst for the military. Wolfe also has worked as a web site architect and computer analyst for a major national information management and electronic commerce systems company that catered to the financial services industry.

Wolfe was approachable and displayed a very friendly disposition. One of the interesting things about Wolfe was the promptness of his/her replies when emailing. This surprised the researcher, as faculty members usually request a courtesy turn-around time of 24 hours. Wolfe's replies by email were measured in a fraction of an hour at most.

When compared to Agustine and Otter, Wolfe was more explicit in expressing the reason why accessibility to the students was key for him/her, as it was based on personal experience:

> I think that I try more than anything else to be accessible. As a teacher I do not want to be or seem too aloof or unconcerned with the students' learning. I certainly had professors in college that seemed a little aloof and whether or not they seemed it or I interpreted that way I don't know. But, if anything I try to make myself available and accessible.

Wolfe indicated that relating to the students in the program was not necessarily hard if one can relate to their interests. Wolfe suggested that the students in the department shared many of his/her interests and passions, so the process of relating to them has been a very natural process that has worked very well for him/her:

> . . . but I try to relate to their interests, which in a lot of ways in my field is not hard. My department is very full of people that play video games, read comic books and all of these things that I love doing, so it works pretty well. So I don't have a hard time with that.

In relating to them, Wolfe also reported making sure that the students know he/she is accessible and that they can ask questions. Wolfe also brought out the concept of fairness to students but above all, he expressed concern about the mastery of the material. This was very similar to, but more explicitly stated, than Agustine's concerns.

> I also try to make clear with them and solicit questions as often as I can. That doesn't always succeed. Sometimes they still don't ask questions, but it's certainly important to me that they know they can ask questions. I also try to be fair. Obviously, I think every professor tries to be fair but I, I try to go out of my way and make sure that one opportunity that isn't given to a student isn't given to everybody else. But in the flip side of that I do care more about their learning the material at some point during the course than never. And so I have been over the years known, I think somewhat, for being flexible on my due dates. Uh, also accepting late work even if there is a penalty because again I want them to do the work even if it's late. So, you know, an automatic zero for a few days late doesn't usually happen with me unless there is some other reason. So, accessible, fair and interested in their learning.

Wolfe had taught the class before as a laboratory assistant, but in this semester Wolfe was doing both. In total, Wolfe had been teaching this particular course for a year. As such, Wolfe made some modifications to the course. One of them was the shift from the departmental server to WordPress:

> From a logistical perspective, I use WordPress as an organizational tool for the course. Previous instructors have used the departmental server and they have used their own software, but uh, I decided I did not want to rely on that so I moved it to an off-property or off-university system. That doesn't really change the content of the course. It's just logistics.

Some of the other changes involved updating the content to make it relevant and make it more reflective of trends in the industry:

> The only big changes I'm making are addressing uh, HTML 5 which our course is primarily about Flash and interactive design using Flash and right now there is a lot of attention being uh, given to HTML 5 as a viable alternative to that. I don't know yet, because I have to see kind of how do we get the requirement outcomes with Flash but I would like to incorporate some of that, at least a very cursory view of 'Why is it a viable alternative?' I don't know yet that there will be significant. In fact, I know there won't be enough time really to dig in because it's such a short semester anyways, for the summer. But that's my intent, to cover HTML 5."

This course was also production-based. Because of this, Wolfe had some very specific objectives for the students to achieve as a result of taking the class:

> This course is critical for several reasons. One, it teaches the principles of design and so when they leave this course they should at least be able to sit down and design a web application, a web site, some kind of a piece of media, interactive media. Potentially like an iPhone app, you know. Really the design principles transcend which, you know, implementation, so that's one goal, one objective. They should leave and say: 'I have an idea of how to make a design.' They're not going to be experts. They're not going to make, you know, award-winning design from this class alone, but they'll at least have a framework to approach it with. And not just, uh, passive design but interactive design and that's a big critical thing about this course is: How do I make a system that encourages the user to interact with it and does so in a way that's pleasing? That's the main thing.
>
> Another thing is for a lot of students it's the first time they're using Flash so leaving this course they should have a good understanding of dealing with Flash and ActionScript which is the programming component of Flash so that in future courses where the implementation is left to them, if they want they can approach it with this. Um, now with my modification of HTML 5, my goal for that is just going to be that they have a basic understanding of HTML 5, why it's a viable alternative to Flash and know enough that if they're interested they can pursue it. It will be up to other courses and indeed is kind of the incentive of the program to develop the skills to teach them Javascript, CSS, and these other things that follow.

When he reflected on his/her teaching, Wolfe, stressed the importance of caring for his/her students but at the same time, was mindful of the need to enforce accountability for the students. Wolfe's goal was to maintain that balance between the two:

> I think when I started teaching I was teaching from the perspective of a student, because I was still a student at the time. I didn't finish my Master's until 2004, so I was teaching while going to grad school. I literally graduated with my bachelor's in 2000. And I brought a lot of the student's perspective to that early teaching time. As I've become less and less attached to that and it has kind of faded in my memory, some of the things are still there--some of the things I think I've mentioned, things that I recognize as a student but I've also adopted a little bit more of what I would consider you know, the uncaring sort of non-sympathetic: 'This is the due date, this is the requirement.' More than the due date, this is the requirement. That's one the things that I have learned from my faculty friends here. If you put out a homework specification, not only is it important that, you know, it's well defined. Originally, you know, back when I started teaching I was very flexible about that. I would try to be rigorous but I know a lot of times I'd say: 'I know he knows what he's doing here' or 'She really did a good job here so I'll give them this grade,' you know? There wasn't so much as a rubric, there wasn't so much of a conception of rigorous guidelines. But over the years I've tried to, and I know I've succeeded in some ways, adopting stricter guidelines. So even if the due dates are somewhat flexible and I do allow late work and that, I stick to the spec [specifications] and I preach they need to stick to the spec. If they don't, after the first couple of assignments they don't know me, they'll learn that you know, 'you have to do what it says to do.' And that's important because quite frankly, in the real world working with contracts and clients, this is what you do.

Object

In the CHAT framework, the object refers to the goals toward which the activity is directed. For the purpose of this study, the object referred to the successful teaching of a course by each faculty member.

Purpose or Outcome

In activity theory, activity is carried out for a purpose or outcome. Typically, this purpose is the motivating force behind the activity. With the media selection activity, the faculty members reported a slight variation of the goals as their courses differed; however, one goal common to all three was that the outcome of the media selection

process was intended to support the objectives of the class as evidenced in the following statements:

AGUSTINE: “The biggest thing has to do with whether or not it makes the point. You know, is it valid?”

OTTER: “Um, It depends on what I'm trying to show, Um, multiple layers of being able to communicate the idea.”

WOLFE: “It is useful if it helps sell or explain or if it allows the student to understand a learning objective.”

Throughout the study, the participants mentioned using the media selection activity as a supplement to the material contained in their lectures. Although the courses they taught were different, the patterns of their explanations were strikingly similar. They initially stated that the media selection activity was supplemental and assisted in clarifying course content. They further observed that the selection of media itself was not difficult. Complications emerged regarding their awareness regarding the availability of the media to them and their students, accessibility of the media, and whether the media was helpful in communicating ideas to their students.

Community

The CHAT framework triangle introduces the concept of community at its base with one node exemplifying division of labor and another presenting rules, norms, and conventions. The faculty members discussed the context of their individual and collective efforts. This section begins with a general discussion of the community and proceeds to

review the division of labor in these communities along with the interaction of the community with the rules, norms, and conventions.

The Importance of Community

The community plays an important role in the media selection activity context. The community helps shape the faculty member's media selection task. The community defines the task, the requirements and related administrative policies. During the study, the participants observed at the studied department made mention of the tools that the community at large (the university) provides. These include Blackboard and tools such as the server that the department provides for its members. The community, for the most part, uses its departmental server, and this offers advantages to students in terms of consistency throughout their program of study. In general, the department staff has favored use of the departmental server over the university-sanctioned Blackboard for a variety of reasons (autonomy, ease of use, convenience, versatility). But, several of the faculty members who were observed chose other tools instead of the departmental favored tool. Agustine explained:

> What is nice about WordPress is you can actually [force] stuff together and make it what is what not supposed to be. It was supposed to be a blogging software and can be turned to a real media-rich content management system with a nice interactive schedule and other things.

Wolfe further explained how WordPress allowed him/her to link class material, relevant articles and other information that he/she finds online into one place where students can access it:

> I use WordPress as an organizational tool for the course. Previous instructors have used the departmental server and they have used their own software but uh, I decided I did not want to rely on that, so I moved it to an off-property or off-university system. That doesn't really change the content of the course. It's just logistics. I also. . . and have tried and [am] going to keep trying to put relevant articles, things I find online, up on this system. These are not required readings but they are things that I think compliment what we're doing in class and I've always been a big proponent of trying to tie in timely web articles, web things, things that I am reading, into the class as well.

This discussion has focused on the influence that the community has on the media selection task and how it affects the choices the professors have made. None of the faculty members indicated that their department imposed requirements as to use of a particular media for their teaching activities. On the contrary, the department had no requirement nor did it provide guidelines for the media selection process.

Division of Labor

In the CHAT framework, division of labor refers to the point where the community and object intersect. Labor in CHAT theory, can be divided horizontally between community members of approximately equal status and vertically between community members with different levels of status.

There was evidence of both types of division of labor taking place. Evidence of horizontal division of labor manifested itself as students divided the tasks in order to complete group work and provide peer review of their work. Vertical feedback was observed as the faculty members, particularly Otter, shared the task of providing feedback with the students for the individual projects.

During one of the interviews with Otter, he/she observed that most of his/her

peers standardized on the use of the departmental server as a tool. Otter viewed this as an advantage:

> "The departmental server is convenient and everybody in my department is using it, so the students should have an understanding on how to use it. I was kind of surprised this semester because just talking to the other instructors this semester they said: 'By this time, by the time they take your course, they should have been using the departmental server.'

Even though Otter did not specifically state his/her expectation that the departmental server would make it easier for students by providing a consistent tool among courses, that expectation was implicit as evidenced in his/her comment about his/her students: "It still winds up to be that's there are still people that, you know, haven't done it and they don't know how to log in."

Rules, Norms, and Conventions

In the CHAT framework, rules, norms, and conventions for the activity are represented where the community and the subject intersect. In CHAT, the three sides of the outermost triangle represent a subject acting on an object while embedded in a cultural community. There is interaction between the nodes; therefore, tools can mediate a subject's action on an object. Interactions between a subject and an established community are governed by established rules and customs. A community interacts with an object or objects through the division of labor. All of these interactions are driven by a planned or anticipated outcome or purpose.

This section of the chapter begins with a description of the media selection in place followed by examples of that intersection.

The Broader Context

In order to understand this node of the CHAT framework one must examine the broader context of the activity system. The university must satisfy national and regional accreditation requirements, and the department must also satisfy accountability requirements established by itself, the college, and the university for its programs. Although the department has not set guidelines for media selection for the faculty teaching courses, some goals as to number of students in the program and expected program growth have been defined. Otter shared his/her views on this topic: "When my department head told me about this increase in class size, I immediately asked, 'How am I going to keep the quality of instruction?' and his response was, 'Do what you can do.'"

Given UCF's tremendous growth over a short period of time, this policy can be assumed to be an expected one. At the time of the current study, UCF had grown to be the second largest university in the nation in terms of student enrollment.

Making Choices

The researcher discussed the choice that was available to the participants in terms of media selection. Participants, in response to questions about limitations that might be imposed on their selection process, reported that they had a lot of choice and flexibility:

AGUSTINE: “No, not with my department. We basically use, usually the people who work here have their own forte or their own strengths, and they use whatever is strong for them.”

OTTER: “No. Other than the fact that in this course I'm teaching these two programs, and in my visual language course I'm teaching Maya, but they don't have any recommendations about say, about films that I show (because I also use films), and video tutorials, and things like that in other courses I teach.”

WOLFE: “None that I am aware of. The department may in some document, in some file somewhere, have this listed but I have not received this information [if it exists].”

Tools

Faculty members had a variety of tools at their disposal as they engaged in their teaching tasks. The previous sections mentioned some of the tools at their disposal. This section of the chapter focuses on those tools and provides more detail about these tools and how they were used by faculty.

The department has provided faculty access to its server, which was designed to serve as a content repository and main point for students in the department to see their course syllabi, assignments, and program information. Accounts are issued to active faculty members and to students actively enrolled in the department classes. All users are required to abide by the UCF’s Use of Information Technology and Resources policies while using these resources. Most faculty members applauded its ease of use and the fact

that students were able to rely on a single system. The departmental server has enabled (a) a centralized place to locate all course-related content offerings, (b) uploading and tracking capabilities for student assignments, and (c) the sharing of student work. Otter explained: "I have a core place to go (server) and know when they posted it because it gives me a time and date and all that good stuff so it's good tracking. And its accessible so they can look at other student's work."

It is important, at this point, for the researcher to insert an explanation regarding course modalities and the implications for tool use. Face-to-face courses have no technology requirements, but fully online courses are required to have a Blackboard section.

Web tools

Although the university has its sanctioned system for course management, Blackboard, most faculty members in the department either use the departmental server or they use their own tools. That is not to say that they do not use Blackboard. Most indicated that they used Blackboard to post grades in order to satisfy university compliance requirements with Family Educational Rights and Privacy Act (FERPA) and protecting sensitive information. The Family Educational Rights and Privacy Act (FERPA), originally enacted in 1972, was a Federal law that protects the privacy of student education records. The law applies to all schools that receive funds under an applicable program of the U.S. Department of Education. However, in regard to content management and the tools that are used on a day-to-day basis, there has been a range in

the tools that are used. Some faculty members observed used WordPress because of the simplicity and adaptability to use the software to meet their needs with a minimum effort.

For Web browsing and general Internet usage, the faculty members indicated they used Safari and Firefox as their primary browsers in finding resources. Although these browsers are cross-platform and available on both Macintosh and PC, Safari seemed to be a logical first choice since most of the laboratories were Macintosh based as is usually the case in the creative arts field. During the lectures, the usage was split between Safari, Internet Explorer, and Firefox. Most of the lecture halls were PC-based, unless faculty members brought their own laptops. Otter, as one example, carried his/her MacBook Pro to lectures and was extremely comfortable as it was his/her main machine. Lecture was an extension of his/her daily activities. As such, Otter preferred his/her Mac over the PC-based consoles on the lecture halls.

For uploading data into the departmental server, faculty members used a File Transfer Protocol (FTP) program called Fugu on Mac machines and its equivalent on the PC workstations called WinSCP. This is standard based software for the campus laboratories and the many classrooms with built-it technology.

Supplemental Tools

All of the faculty members who were observed used PowerPoint for their lectures. Course documents were distributed electronically in a mix of Portable Document Format (pdf) or Microsoft Word document format. In some cases, the documents were HTML pages that were posted to WordPress or the departmental server. It seemed that this was

the normal workflow for the majority of the faculty members for their teaching tasks.

Depending on the faculty member, some of the other software based tools used were Microsoft Excel, Microsoft Word, VideoLan Movie Creator (a cross platform video editing program), Adobe Photoshop (a graphics editing program), Adobe Illustrator (a full-featured vector graphics drawing program), and Mockingbird (a software to make prototypes of application and website interfaces). For presentation purposes, the classrooms were equipped with a workstation, an LED projector, a projecting screen, and doc cams (cameras that serve as digital overhead projectors). In the observations, doc cams were not used at all. Instead, the faculty members used the tools with which they were familiar. Because the participants rarely dealt with paper or print, most of the text was presented digitally.

The Production Consumption Paradox

As previously stated in the discussion of CHAT theory in Chapter 3, a paradox exists within any activity system. Though the total activity is geared toward production, its sub-triangles produce and consume simultaneously. This assists in the overall production of the system. In order to produce in an activity system, energy is required in the form of things that are produced. These things must be produced so they can be consumed and energy produced. This, in turn, aids the outcome of production. Thus, activity systems are driven and exist solely because consumption necessitates production and, in turn, production necessitates consumption. Engeström relied on Marx's (1973) definitions of the terms to explain their meaning:

> Production creates the objects which correspond to given needs; distribution divides them up according to social laws; exchange further parcels out the already divided shares in accord with individual needs; and finally, in consumption, the product steps outside the social movement and becomes a direct object and servant of individual need, and satisfies in being consumed. (Marx, 1973, p. 89)

In the activity system explored in this study, faculty members selected media for their teaching tasks in a particular course in order to meet the learning objectives in the course. They were interested in providing enriched experiences that would lead to success and advancement by their students in the real world. Faculty members addressed consumption issues when discussing their experiences. Most of the participants alluded to cost in terms of time. Otter spoke of "working more than 40 hours a week." Others implicitly stated that the lack of time imposed limitations on "what they wanted to do with the software and explore in the course." Agustine mentioned, "trying to do the best I can in spite of the time I have to cover all the topics."

Otter pondered on the department's knowledge regarding the impact of demands placed on the faculty members in his/her statement that, "The administration is well aware that they are taxing the basic time constraints and energy levels of their faculty. They're well aware."

CHAPTER 6
ANALYSIS AND INTERPRETATION

Introduction

In the literature review in Chapter 2, researchers warned about some of the factors that impeded the technology adoption process in a large-scale implementations. In this chapter, the researcher will try and establish how Engeström's Cultural Historical Activity Theory (CHAT) provides an articulate framework to synthesize these problems.

The visits to the classes at the department described in Chapter 5 presented several key ideas that are contained within CHAT including contradiction between the nodes and within a node. In this chapter, these ideas are studied in a more cautious manner. The chapter has been organized to (a) analyze changes to the activity system, (b) relate the CHAT analysis to previous literature on technology adoption, (c) propose answers to the research question posed at the outset of this study, and (d) suggest areas for further research.

Analyzing the Tensions Within the Educational Media Selection Activity System

In this study CHAT was used to analyze the media selection activity of three faculty members at a department of a large southeastern university. Tensions in such an environment are inevitable and understanding these tensions can enhance the understanding of the problems raised in earlier work regarding technology adoption. A detailed analysis and understanding of the media selection activity may offer practitioners, department chairs, and stakeholders awareness that can improve and

streamline their processes in considering the adoption of educational media for their teaching and learning activities. This is where CHAT can be used as an intervention (Engeström, 1999).

Primary Tensions

A primary tension refers to a tension that is within an individual node of the activity system. In the example Holt and Morris (1993) provided of the Challenger disaster, one example of a primary tension was the conflict in the Community node regarding the status of the shuttle program between being defense-dependent or self-sustainable. Some of these tensions were similar across the faculty members who participated in this study.

Tensions Within the Subject Node

Otter expressed his/her frustration explaining the dilemma regarding offering timely versus detailed feedback. Otter felt that if he/she offered timely feedback amidst the increase in class size. It was his/her belief that the feedback would not be as detailed and, thus, less useful for the student as its quality would be greatly diminished because of the time limitations. This was not acceptable to Otter and was the reason the conflict surfaced.

Tensions Within the Tools Node

Wolfe stated that "I can integrate multiple information sources easily" as his/her reason for choosing WordPress over the other course management tools. Wolfe chose WordPress because it was a more compatible tool for him/her to use in order to integrate RSS readings, video clips, and other media into his/her course. His/her alternative would have been to use Blackboard and go through a lengthy process to do so in order to provide the same capability.

Tensions Within the Rules/Customs Node

One of the primary tensions present with all three faculty members was within the Rules and Customs node. All three faculty members experienced conflicts with the established norms and conventions within their environment.

Agustine did not want to use Blackboard because he/she "did not want to lose control," and he/she did not want to be subjected to someone else's schedule when it came to planning his/her work. Also, he/she believed the reliability of WordPress was better than dealing with Blackboard's weekly downtime. Agustine also used WordPress to put up the course content because of its adaptability and the fact that "you can force stuff together and make it what is not supposed to be." This could be interpreted as an issue related to individual versus departmental control over the creative and teaching process. Faculty members may argue that they want to have control over the teaching and that includes the flexibility to modify or alter the systems they use to present their material.

Secondary Tensions

A secondary tension consists of conflict between different nodes in the same activity system. Using the Holt and Morris (1993) example of the Challenger disaster, a secondary tension took place between the decision makers who were not only trying to put safety first, but were trying to adhere to an aggressive flight schedule and the community node who struggled between making the shuttle program defense-based or being self-sustainable. With all the faculty members that were observed, there was evidence of such tensions between the nodes. These are explained individually.

Tensions between the Subject and the Community Node

During the interview Agustine shared the following statement which provides an example of tension between the subject and community node: "They are to expect someone who expects the same from them, uh, someone who is more interested in providing learning opportunities than grades."

Agustine was speaking of a tension that might be classified as a secondary tension. In this interpretation, the conflict was between the subject (Agustine) and the community (department or university) node in the activity. The subject node was Agustine who viewed himself as a creative teacher who was concerned with his students' learning. The community node became involved when Agustine's beliefs were in conflict with the department or the university's perceived goal to process students, documenting grades rather than take an honest interest in the student's learning.

Tensions between the Subject and the Rules/Customs Node

Wolfe described an interesting tension that took place. The source of the tension was between him/her and the customs taking place in the environment. The students expected a review before the midterm exam because they had received one for every class they had taken. Wolfe told the students that his/her class had no review and expressed his/her view that college students should not expect a review. This may have been an indication to the students that they would have to adjust their expectations in the college environment. Wolfe opposed the established custom regarding exam reviews and, by doing so, did not meet the students' expectations of receiving a review before the exam.

Agustine's described tension in the above section can also have an alternative interpretation. The subject node in an alternate scenario would continue to be focused on Agustine and his concern for his students' learning. The rules node would be the consideration in that Agustine's beliefs may have conflicted with the department or the university's administrative requirements that could be viewed as rules or customs. As such, the result may be the perception that some faculty members simply routinely process students, documenting grades rather than take an honest interest in students' learning.

Otter discussed a conflict happening between the same nodes but with a different focus. His/her teaching beliefs may have been in conflict with the established customs and conventions originating in the department university. For example, the conversation and casualness of tone that Otter liked may come into a conflict with established

academic customs particular to higher education. At this level, it may be perceived that many professors choose not to engage students on an equal playing field and may prefer the established formality that has come to be expected in professor-student relationships.

Wolfe recounted a tension similar to that mentioned by Otter. Wolfe related his/her experience of having faculty members who were unconcerned with his/her learning during his/her academic career. It may be perceived that this is seen as customary in the higher education circles for this to occur, as faculty members have numerous engagements and demands placed on them such as research, department meetings, and increased teaching loads. A secondary tension present takes place between the subject and the rules/customs node. This tension surfaces when the values of the subject, i.e., concern for students' learning conflicts with the customs node, i.e., perceived distance of faculty members from students.

Tensions between the Subject and the Tools Node

Otter mentioned a secondary tension present in the activity system, one that reflected the tension between the subject and the tool section. Otter had two tools consisting of Blackboard and the departmental server and chose the departmental server because of its ease of use in contrast to Blackboard. Also, the departmental server provided the convenience and simplicity of one tool which would permit one site to serve all course needs, i.e., residual site for course content, student's assignments, student collaboration activities and shared work.

Wolfe described an interesting secondary tension between the subject and tools

nodes. Like Agustine, Wolfe made the choice to use WordPress rather than the departmental server, the tool that was provided by the department. Wolfe also chose to avoid Blackboard, the university sanctioned tool, because WordPress provided a better solution for him/her in ease of integrating relevant information and Internet articles into his/her standard course content.

The three faculty members used the university sanctioned tool only for the purpose of meeting the official university mandate of reporting grades in a system that was secured pursuant to Family Educational Rights and Privacy Act (1972) requirements. Agustine and Wolfe did not use the departmental server, which was the department-sanctioned tool. Rather, they used an existing tool (WordPress) and modified it to meet their needs. Otter was the only professor in the observed group that used the departmental server.

Tertiary Tensions

A tertiary tension, as previously described in Chapter 3, is one between the activity itself and a culturally more advanced form of the activity. In the media activity selection, there are a number of tertiary tensions that can be explained.

Otter experienced a tertiary tension that was reflected in the dilemma of increased class size versus faculty constraints. Otter was frustrated as the class size increased because of the implications he/she would have for teaching and providing high quality feedback for all students in the class. This was not a problem prior to the class size increase. Previously, the classes had small sizes and as such, Otter was able to take the

time to personalize instruction and provide high quality, detailed feedback for every student. We could argue that Otter's teaching was the "old way" of doing things (because of smaller class sizes) and as such, it conflicts with the new form of the activity which is teaching with larger class sizes because of budget constraints.

Agustine's dilemma related to the loss of control had a more plausible interpretation that surfaced as a tertiary tension, one which was similar to Otter's experience. It could be argued that Agustine's old way of teaching was in an environment where he/she had absolute control of everything related to his/her course. With the advent of distance education and course management systems such as WebCT, he/she has been forced to adapt. Because of this, he/she would "lose" some of that creative and process control. This could, therefore, be seen as a conflict between the older ways of teaching versus the newer ways of teaching using course management systems like Blackboard. He/She used WordPress because of the ability to retain absolute control and independence from any other system for his/her teaching tasks.

Quaternary Tensions

A quaternary tension, as previously described in Chapter 3, is one between two nearby activity systems. In the media activity selection, there are a number of quaternary tensions that can be explained.

Agustine shared a quaternary tension between the activity system of the subject (himself/herself) using WordPress and the activity system of the university (community, rules) in which the subjects were expected to use Blackboard. Otter also shared some

similar insight about the same tension. The difference was in his/her use of the departmental server rather than WordPress as a tool in his/her teaching tasks.

There was also a quaternary tension between the activity system of the faculty member and the activity system of the university as seen through Otter's eyes. Though the primary mission of a university has been to educate and provide knowledge, the increase in class size threatened that very same mission in that the quality of the teaching suffers as seen from the faculty point of view.

Otter related another tension present in the system. This was an example of a quaternary tension between the activity system of the subject (Otter) and the activity system of the instructor handling the laboratories. In this tension, the conflict can arise when the outcomes and objectives presented in the lectures by the participant are not carried out by the instructor that handles the laboratory component of the course. The result can be a lack of synergy between the lecture and the laboratory experience. It can affect the objectives of the course and the accommodations that must be made by the professor of record.

In addition to the tensions described previously, five consistent themes emerged consistently throughout the study:

Group work. All three participants shaped their courses to include group work. As previously discussed, this was an example of division of labor in the activity system. Given that the courses being taught were production courses, groups could mimick real-world settings in which students were expected to collaborate with others in order to achieve a certain goal.

Autonomy. Participants reported that they had the freedom and flexibility to choose appropriate media according to their needs. There were no official guidelines at the department level. It is important to note that the researcher selected courses that were conducted in face-to-face modality because of the convenience of being present during the class and laboratory sessions and being able to observe the participants within their activity system. As such there were no media requirements for face-to-face courses as opposed to the other modalities.

Media as a tool to achieve learning goals. All participants discussed media as a tool to supplement the learning outcomes of the courses they were teaching.

Caring for students. All three participants were concerned about their students. They expressed concern for their students' success. This concern was balanced with concerns for fairness and the need to hold students accountable. All of the participants considered accountability to be a vital skill in real world scenarios.

Early adopters and staying current in the industry. All participants updated their course content on a regular basis to integrate the latest developments in their field to keep the content relevant.

Research Questions

Two research questions were formulated to guide this research. The following discussion has been organized to address each of these questions.

Research Question 1

> Why do faculty members in higher education make the instructional choices they do with respect to educational technologies and media?

The participants talked about the tools that they used in their teaching and learning activities. Agustine shared that making the media choice was not the difficult part of the process. The important factors were availability, accessibility, and making sure that the media served as a supplement to what he was teaching. In other words, the essential factor was to make sure the media supported the central focus of the instruction. Otter agreed with Agustine that the media selection process was not difficult. Depending on the task at hand, one particular media technology may better serve its users than another comparable tool. In Otter's words, "It's about having multiple layers of being able to communicate the idea." Wolfe stressed the importance of time constraints, convenience, adaptability, and autonomy in the choices that faculty members made in regards to their tools.

Research Question 2

> How can the use of CHAT, as a more robust framework, offer an increase in explanatory power to better enable the understanding of a multitude of factors that impact the adoption and use of certain media technologies?

In Chapter 5, the data were presented through the lens of the CHAT framework. The analysis helped reveal the tensions and aided in their analysis in the activity systems of the participants. The presence of tensions at the primary, secondary, and quaternary

levels was exposed, and the analysis highlighted the involvement of the rules, norms and conventions in many of these tensions.

In addition to the tensions described above, five consistent themes emerged consistently throughout the study: (1) group work, (2) autonomy, (3) media as a tool to achieve learning goals, (4) caring for students, and (5) early adopters and staying relevant to the development in their field.

Significance of the Study

The work presented in this dissertation is noteworthy for two reasons. First, the researcher investigated faculty experiences in selecting educational media tools for their teaching and learning activities. This study raised awareness of the factors that surround media selection activity systems such as teacher satisfaction, suitability of tools for teaching and learning outcomes, time demands, and departmental and institutional expectations for growth. Also, understanding the impact of these forces allows for improvement in teaching, program and course implementation, tool design and general policy.

Technology adoption is more than a choice of tools. It involves the parameters in which individuals work with these tools and how faculty members use them to increase and aid in the teaching of the course content. It is a very dynamic and complex process with many variables that are in constant interaction.

Secondly, the researcher has demonstrated the ability of the CHAT framework to serve as a lens through which to consider the many factors that impact the adoption and

use of certain media technologies. CHAT can help technology users to observe and analyze the complex act of selecting media technologies for teaching. This framework helps users see the media selection activity in a broader context. Included are the demands, expectations, and requirements of the culture in which the individual is situated. In this study, the tensions present in the activity system for a group of early adopter faculty members were revealed. It can be argued that these tensions would be significantly magnified for other adopter groups such as late majority or laggards. If this is the case, there is a need to create awareness so that policy and tools can be modified and all of these factors can be considered in the continuing process of technology adoption in higher education. All stakeholders need to be aware of these interactions as they plan for the choice, design, and implementation of technology at classroom, departmental, or institutional levels. Decisions regarding tools are often made at the administrative level with no input or feedback from the faculty who will be responsible for implementation. These choices may not be the best for teaching, learning, and student motivation for learning.

Implications for Future Research

This research has led to additional questions worthy of further study. Following are several areas which might be explored in future research:

1. In this study, the sample size was small and limited to one department. Further study with larger and different groups may provide different results in terms of media selection choices faculty members make.

2. In this study, individuals were observed who would be considered early adopters. These participants were part of a department heavily involved in media technologies. Because of the nature of their work, their creativity was a given. A question arises as to the choices individuals in other adopter categories might make. Thus a question for future study would be related to the relationship, if any, between the technology comfort levels of individuals and the choices in selection that they make in selecting media for use in their teaching?
3. The relationship, if any, between faculty members' adopter status and the factors that affect their choice of media tools could be investigated to determine those factors that affect choices in educational media.
4. Faculty members in this study selected tools based on convenience, flexibility, and adaptability to support the learning objectives of the course. A study could be conducted to explore the relationship between the faculty's choice of educational media and student achievement and the extent to which the matching of technology to learning objectives translates into increased achievement for students.
5. More research on the tensions in the CHAT framework and themes is suggested.
6. It can be argued that Otter's experience is indicative of the future of education. With constraints on budgets and an increasing number of students in classes, how do faculty and student satisfaction affect the choices that

faculty members make in media selection process? Administrators making technology decisions need to consider faculty teaching, student learning, and allow faculty to have more input in the process.

APPENDIX A
HISTORICAL CHAT OVERVIEW

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"Vygotsky's Neglected Legacy": Cultural-Historical Activity Theory

Wolff-Michael Roth
University of Victoria
Yew-Jin Lee
National Institute of Education, Singapore

The authors describe an evolving theoretical framework that has been called one of the best kept secrets of academia: cultural-historical activity theory, the result of proposals Lev Vygotsky first articulated but that his students and followers substantially developed to constitute much expanded forms in its second and third generations. Besides showing that activity theory transforms how research should proceed regarding language, language learning, and literacy in particular, the authors demonstrate how it is a theory for *praxis, thereby offering the potential to overcome some of the most profound problems that have plagued both educational theorizing and practice.*

KEYWORDS: cultural-historical activity theory, dialectics, theory-praxis gap, activity systems, contradictions, learning, development.

More than seven decades ago, the Russian psychologist Lev S. Vygotsky (1934/1986) noted that (educational) psychology was in a state of crisis because of the "atomistic and functional modes of analysis . . . [that] treated psychic processes in isolation" (p. 1). Specifically, he pointed out that the separation of intellect and affect

> as subjects of study [was] a major weakness of traditional psychology, since it [made] the thought process appear as an autonomous flow of "thoughts thinking themselves," segregated from the fullness of life, from the personal need and interests, the inclinations and impulses of the thinker. (p. 10)

These analytic challenges remained unresolved for years, leading Vygotsky's student A. N. Leont'ev (1978) to continue expressing dissatisfaction over the eclectic state of (educational) psychology. As readers will quickly verify, it is difficult to find research recommendations concerned with knowing and learning in and out of schools and across the life span that take into account the kind of holistic integration that Vygotsky had originally championed. Now, as then, we are confronted with a number of conundrums in educational research and practice, which advances in modern psychology have not fully overcome. To better place these issues in context, we present a short vignette below that conveys something of the multiple tensions facing classroom teachers and educators everywhere.

Katherine, a fifth grade teacher in a rural district, is busy planning an introductory lesson on electrical circuits. Because she already has taught her students in previous grades, she feels that the model lesson plan provided in the teachers' guide will be ineffective, if not a big turn-off for these children, who value meaningful, hands-on learning. This feeling is exacerbated because there are a few children in the class who find handling the English language and the language of science concurrently almost too great a burden to bear. "I'll give them lots of time to explore, in small groups, to set up the two circuit layouts and to discover about the concept of current flow at the same time," she ponders by herself. With the push toward increased accountability by her school board, however, Katherine feels compelled to abandon this option and instead rely on direct teaching as the method of choice, given its economy of instructional time and assurances of mastery learning and higher achievement scores. During the week, she sees excited faces slowly dim, although she finishes the learning objectives comfortably within the prescribed time slot. Experiencing some remorse for her pedagogical decision, Katherine consoles herself by saying, "One or two will ultimately make it very big, although most will find their own niches in society and be equally happy. Anyway, I'll make it up by giving them a couple of fun experiments at another time."

In this episode, we see Katherine struggling with contradictions arising between her personal experience and professional sense of what is best for these children and generic statements about what to achieve and how to best attain it. At this time, Katherine does not have the theoretical tools that would allow her to understand that when children choose the motive of activity, they also become emotionally engaged and that learning, which is an expansion of one's action possibilities, is a by-product of the pursuit of motives and goals. She also does not have the capacity that would allow her to understand how language, or rather the utterances students make, is a means to mediate the concrete realization of the goals the children set for themselves during exploration tasks. That is, Katherine does not have a holistic theory of practical activity consistent with her professional life, which would very likely increase her confidence and teaching abilities—at least this is what happened to one of the authors in a curricular unit described later. This theory would in fact help Katherine understand that she is a member of a historically situated educational community, which, after years of more open constructivist approaches to science and mathematics education, has now moved to impose external (political) control through the rigid application of high-stakes examination and accountability procedures.

We therefore observe in this fictitious though commonplace episode with Katherine some of the troublesome questions in education that refuse to go away, including the theory-praxis gap (Roth, Lawless, & Tobin, 2000), the tensions between the epistemological and ontological aspects of human development (Packer & Goicoechea, 2000), the differences between decontextualized and embodied knowledge (Lave, 1993), the difficulty of planning for specific forms of learning (Holzkamp, 1992), and the apparent disjunction between individual learners with other learners and their social environments (Barab & Plucker, 2002; Shultz, 1986). These contradictions, which pervade the everyday lives of teachers such as Katherine, definitely have their parallels among educational researchers too. However, there is a growing movement that does justice to Vygotsky's "fullness of life," which is especially concerned with the primacy of praxis.

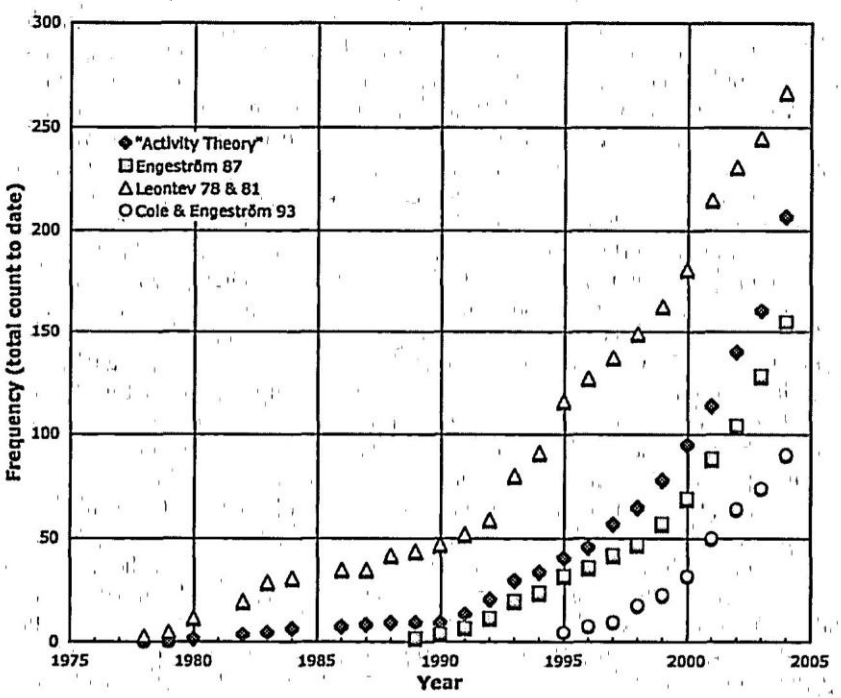

FIGURE 1. *Four indicators of the increasing interest shown in cultural-historical activity theory (CHAT) over the past three decades. These citation frequency indicators each reference major CHAT publications (in English) and the search term* activity theory *in the Institute for Scientific Information's citation database.*

Said to be "the best kept secret of academia" (Y. Engeström, 1993, p. 64), (third-generation) cultural-historical activity theory (CHAT) offers the possibility to overcome some of the aforementioned divides besides recovering more humane forms of education. For these important reasons and more, this review showcases CHAT as an integrative road map for educational research and practice. An introduction to CHAT in a special issue of *Mind, Culture, and Activity*, a journal that focuses on interdisciplinary approaches to culture and psychology, provided evidence of the exponentially rising attraction of activity theory, as indicated by various citation-related factors (Roth, 2004). If the latter are accepted as reasonable indicators of interest in a particular theory, then Figure 1 clearly shows the penetration of CHAT into the Anglo-Saxon literature, on the basis of our analysis of the Institute for Scientific Information's Web of Science databases using influential CHAT publications (i.e., Cole & Engeström, 1993; Y. Engeström, 1987; Leont'ev, 1978, 1981) and the search term *activity theory* (see also below). This theory is of immense interest to us because it has shown to be fruitful for both analyzing data recorded in real classrooms and designing change when trouble and contradictions become evident in these cultural settings.

The purpose of this article, therefore, is to explicate activity theory as an intelligible and fruitful alternative to existing psychologies of learning that overcomes some problematic dualisms in education. We further suggest some implications for educational practice and claim that using CHAT leads to changes in the location of representing what is educationally relevant: Its inherently dialectical unit of analysis allows for an embodied mind, itself an aspect of the material world, stretching across social and material environments. This transactive perspective, which CHAT has in common with other approaches within the sociocultural family of learning theories (e.g., Hutchins, 1995; Pea, 1993; Rogoff & Lave, 1984; Wertsch, 1998), theorizes persons continually shaping and being shaped by their social contexts that immediately problematize knowledge as something discrete or acquired by individuals. In fact, CHAT explicitly incorporates the mediation of activities by *society*, which means that it can be used to link concerns normally independently examined by sociologists of education and (social) psychologists. This desirable synthetic approach is possible only because activity theorists are concerned with upholding human activity—the historical results of the division of labor—as the fundamental unit of analysis, which had partially existed in the work of Vygotsky (Cole, 1985; Glassman, 1996). At the risk of oversimplification, Vygotsky privileged sign or semiotic mediation, especially in the form of speech, whereas the activity theorists succeeding him widened the scope to view object-related practical activity as the proper unit of analysis (Kozulin, 1986), as described in the next section, on the origins of CHAT.

A Brief Historical Overview

The contemporary interest in CHAT is remarkable given that its lineage can be traced back to dialectical materialism, classical German philosophy, and the work of Vygotsky, who created what is referred to as first-generation activity theory. It was substantially developed by two of his students, Aleksandr Luria and A. N. Leont'ev, to incorporate societal, cultural, and historical dimensions into an explication of human mental functioning (Eilam, 2003; Stetsenko, 2003), leading to what constituted second-generation activity theory. Whereas Vygotsky formulated practical human labor activity as a general explanatory category of psychology, he did not fully clarify the nature of this category. It was left to Leont'ev to make historically evolving object-practical activity the fundamental unit of analysis and the explanatory principle that determines the genesis, structure, and contents of the human mind. By taking practical labor activity as coextensive with cognition, it is the work of the latter that is recognized as the cornerstone for present forms of activity theory, together with its broader application to classroom learning, linguistics, and speech act theory (Langner, 1984c).

Consistent with its historical focus, we offer a brief history of CHAT in the Western world in this section. Although both Vygotsky and A. N. Leont'ev grounded their work in Marxism, many Anglo-Saxon scholars found it easier to appropriate key aspects from publications of the former than those of the latter. This differential acceptance may be attributed to a variety of reasons: (a) there was a diminished emphasis on this intellectual inheritance—Leont'ev (1978), for instance, devoted two of five chapters to Marxism, whereas there are only two references (index entries) in Vygotsky (1934/1986); (b) the idea of practical "labor activity as an explanatory principle and the idea of determination [of mind] through

activity (even if indirectly) was not represented as logically necessary" (Davydov & Radzikhovskii, 1985, p. 56); and, therefore, (c) the historical aspect of culture and cognition easily could be abstracted and glossed over. It is interesting to note that scholars basing their work in Vygotskian philosophy generally term their approach "sociocultural," whereas those walking in the footsteps of Leont'ev prefer their research to be known as "cultural-historical."

CHAT penetrated Anglo-Saxon academia rather late; historians may come to identify in Michael Cole the single most influential person for acquainting Western scholars to this tradition, both through his writings (e.g., Cole, 1988) and through the mediating role of his Laboratory for Comparative Human Cognition (LCHC) at the University of California, San Diego (Cole, 1984). At LCHC, many of those who contributed to the spread of sociocultural and cultural-historical frameworks devoted time, interacted, conducted projects together or in the same contexts, and jointly published, including Yrjö Engeström, Jean Lave, Barbara Rogoff, Sylvia Scribner, and James Wertsch (e.g., Cole & Engeström, 1993; Laboratory for Comparative Human Cognition, 1983). Activity theory further received impetus through publications such as *The Concept of Activity in Soviet Psychology* (Wertsch, 1981), *Learning by Expanding: An Activity-Theoretical Approach to Developmental Research* (Y. Engeström, 1987), and the newsletters associated with LCHC. Over the past decade, it also enjoyed wide dissemination through works from the Center for Activity Theory and Developmental Work Research at the University of Finland, Helsinki (e.g., Y. Engeström, Lompscher, & Rückriem, 2005). An older, albeit less recognized, influence on Western scholarship surfaced in Germany, Denmark, and Austria through Soviet works translated into German. These translations allowed Klaus Holzkamp and other German critical psychologists to elaborate CHAT faithfully to its dialectical roots (Teo, 1998). Intellectual influences from this group in Western learning research can be felt far away through the writings of anthropologist Jean Lave (1993, 1996, 1997) and psychologist Charles Tolman (1994; Tolman & Maiers, 1991), among others.

In the former Soviet Union, CHAT was characterized by its more descriptive focus on personality development and the use of activity as an explanatory principle at the level of human actions rather than an interdisciplinary topic of investigation or intervention more common outside that country (Bedny & Karwowski, 2004; Hakkarainen, 2004; Valsiner, 1988). A strand of action research, practiced at the Center for Activity Theory and Developmental Work Research, made thematic *tool mediation* by subjects interacting with objects in activity within nonschool contexts. Subsequently, designers of computer systems and software for collaboration (e.g., Nardi, 1996; Redmiles, 2002), information systems designers and managers (e.g., Hasan, Gould, & Hyland, 1998; Kuutti, 1999), and organizational and workplace theorists (e.g., Blackler, Crump, & McDonald, 2000; Morf & Weber, 2000; Thompson, 2004) found much in CHAT that was congenial to their work. Others adopted this theoretical framework primarily for its overt articulation as a theory *for* praxis and practical action, which assisted researchers and practitioners in remedying contradictions that interfered with everyday learning (Daniels, 2004b; Sawchuk, 2003). Here, *praxis* denotes the moments of real human activity that occur only once (Bakhtin, 1993), which distinguishes it from the notion of practice, which is used to denote a patterned form of action, inherently a theoretical signified. When Katherine teaches, she participates in praxis, in which

there is no time out from the situation, and everything she does has consequences. When Katherine reflects about what she has done, the patterned ways that characterize her actions, she articulates practices, not praxis.

Because CHAT addresses the troubling divides between individual and collective, material and mental, biography and history, and praxis and theory (e.g., Cole, 1988), we believe that it is deserving of wider currency in the educational community. Notwithstanding the good intentions of those who propose balancing monism with multiple voices for advancing the field, basic tenets of CHAT have often been misinterpreted in dualistic ways, hence robbing it of much of its explanatory power (Langner, 1984b). In part, the vigorous dialectical materialist grounding of psychology in Marxism that A. N. Leont'ev pursued may have slowed the reception of CHAT in the West (Langner, 1984a). Yet we emphasize that these powerful analytic tools, existing even in Vygotsky's works, have little to do with totalitarian regimes that have falsely masqueraded under the banner of Marxism, socialism, or communism.

Method and Goals

The chief purpose of this review, then, is to introduce CHAT to wider audiences and to share how it can be beneficial for dealing with a number of unresolved problems both in the psychology of learning across the life span in formal and informal (work) settings and in educational practice. Being an accommodating framework—a metatheory (Scribner, 1990) rather than a set of neat propositions—has, however, produced varying interpretations of what legitimately constitutes CHAT-based research. The initial screening for relevance here began by applying the keyword *activity theory* and the names of leading CHAT scholars (e.g., Michael Cole, Yrjö Engeström, A. N. Leont'ev) to the electronic databases in the Social Science Citation Index, PsycINFO, Academic Search Elite, and Linguistics and Language Behavior Abstracts. Newer Internet search engines such as GoogleScholar also proved invaluable in identifying citation references. This first wave yielded over 600 articles, dissertations, book chapters, and book-length treatments appearing from 1970 onward in English and, to a lesser extent, in German (mastering this language, we have read this CHAT literature in the original). It was also found that the bulk of the literature from the Americas and Europe was published within the past two decades.

The resulting list was narrowed down significantly in the second wave of the review process by eliminating studies that referred to CHAT only in passing or those that were not specifically guided by second- or third-generation activity theory per se. Judgment calls were necessary, because CHAT has strong family resemblances and yet is distinct from *situated cognition*, *distributed cognition*, *legitimate peripheral participation*, *actor-network*, and *practice* theories (see Barab, Evans, & Baek, 2004; Cole, Engeström, & Vasquez, 1997). Similarly, by and large not considered here were the growing corpus of important projects that find much sympathy with CHAT but (a) emphasize less the historical determinations of practical labor and historical conditions of culture, cognition, and learning and (b) adhere more to a discursive, semiotic, or multimodal perspective drawing on Mikhail Bakhtin or Michael K. Halliday (e.g., Franks & Jewitt, 2001; Kress, Jewitt, Ogborn, & Tsatsarelis, 2001; D. R. Russell, 1997; Wells, 1999, 2002). This procedure left us with about 350 texts, not all of which are referenced here to eliminate overlaps. Even then, we do not claim that this review is exhaustive, given the

wide spectrum of interesting themes across disciplines (e.g., educational technology, literacy research, communication studies) that surfaced within the final pool of CHAT publications.

Three major goals are emphasized in this review: (a) introducing and explicating the fundamental dimensions and reviewing the existing CHAT literature within educational and educationally relevant noneducational (workplace, informal, out-of-school) arenas; (b) articulating how CHAT has been used to reformulate educational issues, especially in the areas of language, language learning, and literacy; and (c) sketching new and fruitful avenues for learning theory and educational praxis. This separation was made on heuristic grounds, although significantly, we show at relevant junctures how CHAT can potentially overcome some of the nagging tensions in educational research and practice that were alluded to in the opening section. To embark on the first objective in a nontechnical way, we explicate a vignette about an innovative science course held in western Canada designed and implemented according to CHAT principles. Here, seventh grade students investigated a local creek and the watershed it drained over a 4-month period with the purpose of returning the products of their environmental activity—including knowledge created and representations of creek health—to their own local community.

Learning by Participating in Legitimate Activity

Basically, CHAT was conceived of as a concrete psychology immersed in everyday (work) praxis (Vygotsky, 1989). We now describe a school curriculum that was designed according to the principles of CHAT and then introduce some core concepts of CHAT by explicating the vignette. Consistent with the idea of concrete psychological principles, this unfolding of the episode throughout the review serves as a tangible case in point and touchstone for the theoretical questions under discussion.

A Vignette

One day, the two coteachers of a seventh-grade class brought a newspaper article describing the efforts of an environmental group concerned with the health of the local watershed in which the village lies and its major water-carrying body, Henderson Creek. Besides a plea for improving the sorry state of the polluted creek, the article called for a better understanding of the ecosystem as a whole. The teachers asked the students whether they were interested in doing something about it. Excited by the challenge, the students immediately began to brainstorm what they could do, including cleaning up and documenting the litter that had been discarded there. To help students in framing viable projects, the teachers organized an exploratory field trip, assisted by parents and environmentalists, and then brought the children to different spots along the creek. Mediated by teacher questions and inspired by visiting environmentalists, biologists, water technicians, First Nations elders, and local residents, the students, in groups of three to four individuals, then designed their own projects that concretely realized the general call of the environmentalists to generate scientific knowledge and to rescue the creek.

The students enjoyed relative freedom over the design and implementation of their studies. For example, one group of four girls decided to take photographs at various places along the creek and to record their descriptions and impressions on audiotape. Another group decided to sample the creek at different locations for microorganisms and to correlate their frequencies with water velocity. Yet another

FIGURE 2. *This composite video offprint shows the seventh grade students interacting with small children, students, and adults from all walks of life, teaching them about the creek through their posters and showing them how to use the tools for gathering data. Students' knowing exhibited during this open-house event can be understood only if the unit of analysis captures the situation as a whole.*

group decided to investigate stream profiles and to correlate stream speed with depth, while the last group planned to document and identify all plants that grew in the immediate vicinity.

Every other week, the class dispersed for an entire afternoon, with parents acting as drivers who brought student groups to project sites and assisted in supervision. Some parents also worked alongside the children after having received instruction from the teachers in asking productive rather than yes-no questions. During school-based lessons, the children analyzed their data, engaged in discussions, or worked on a problem that one group had experienced, which with the mediation of the teachers, became a common topic for the entire class. Eventually, the students prepared for an open-house event organized by the environmentalist group at which they presented posters and mounted stations where visitors could use microscopes, dissolved-oxygen meters, or colorimeters (for determining turbidity). Many visitors, young and old, attended the open house (Figure 2), which the environmentalists later attributed in part to the children, who incited their parents and other close relatives to attend. The local newspaper featured a story about the children's efforts, emphasizing their contributions to community-relevant knowledge, while a Web site that featured some of the children's scientific findings was created.

In this unit, even students who often do not "succeed" in school science became core participants in the activity, including girls, aboriginal children, and students marginalized because of a "learning-disabled" classification. One such person was Davie, diagnosed as suffering from attention deficit hyperactive disorder (ADHD); he was regularly taken away from normal class work to receive special attention. Video recordings show that in his mathematics lessons, for example, he behaved in ways that teachers immediately labeled as problematic: He was "on task" for only a fraction of the time allotted and did not produce the requisite graphs that the teacher wanted. In the environmental unit, however, he not only generated usable data and graphs but also became a presenter in other classes, taught the teachers of

other classes about how to conduct scientific inquiry in the creek, accompanied other students as a peer tutor in their biweekly fieldwork, and was an irreplaceable participant in the open house, teaching adults and children alike about doing environmental research. Hence, who was deemed knowledgeable appeared to depend more on their involvement within specific settings rather then being an innate or stable characteristic of individuals.

A First Explication

In this vignette, the students have chosen not only the *object* of their actions (i.e., generating knowledge and saving the creek) but also the *means* by which they are to represent it. In fact, the students enact not just any practices but engage in concretely realizing an existing collectively defined *activity* in their municipality (doing environmentalism), *motivated* by a collective, societal concern for the natural environment. This activity already exists in their community, with its characteristic interests, concerns, and objects or motives. Students learn neither to memorize content matter to prepare for the next academic level nor merely for the purpose of passing tests or obtaining grades. Rather, the students learn science (and other culturally valued content matter) because it expands their action possibilities in and for the production of knowledge and *artifacts* that ultimately benefit their community. During the open-house event, the *products* of students' actions and learning are reintroduced into the community, where they become new social and material resources for furthering the learning of others, including environmentalists, visitors, parents, and children. That is, the products of their actions come to be *exchanged* in conversations and *distributed* in the community, which therefore *consumes* what the children have produced and learned. With the publication of their findings and an acknowledgment of their work in the local newspaper, the students also become known as contributors to the cause that this environmentalist group has espoused in the community. That is, the *identity* of the students has changed from being mere middle school students to being young citizens enacting concern for the environmental health of their community.

Within this class, different groups exercise considerable control over the object of the activity and the means to realize it. That is, they realized the overall object or *motive* of environmentalism in complementary ways, some documenting the current state of watershed health through photographs and verbal descriptions, others creating abstract representations such as the correlation between habitat characteristics (stream speed) and organisms (frequencies) using floating objects, tape measures, stop watches, and D-shaped nets. The different means (tools, instruments) mediate the productive activities in alternate ways, leading, not surprisingly, to dissimilar outcomes. Within their groups, not all students do the same things, but they *divide the work* in interlocking fashion; the benefits of working together provide them with greater room to maneuver and more possibilities for acting and therefore afford individuals expanded opportunities to participate in the activity and, therefore, for overall learning and development. Teachers, parents, elders, and other villagers, who contribute to making this environmental unit possible, all play different roles; without their participation, the outcomes would not exist, at least not in the way others come to see them during the open-house event. That is, these other people mediate the activity and many actions that realize it, expanding the range of possibilities, and therefore contributing to constituting the

activity as a more enriched form than if one teacher is to teach the unit on his or her own. With the necessary vocabularies to understand cognition holistically in CHAT, it makes the learning that is normally invisible amenable to deep reflection and analysis.

This brief example stands in stark contrast to the earlier vignette, in which Katherine directly teaches children about electrical concepts. In this science unit on the environment, the collectivity provides opportunities to children for participating in environmentalism and doing so in ways that are utterly beyond the reach of the solo efforts of individuals. Furthermore, the outcomes of the activity cannot be understood apart from the various mediating elements. That is, environmentalism as a whole and each action that contributes to practically realizing it, and therefore the knowing and learning that is going on, cannot be understood without taking into consideration the activity as a whole. This account immediately contrasts with other theoretical approaches to learning that attribute knowing to individual students' or teachers' intentions or achievements—the epistemology undergirding the textbook Katherine used—rather than to the system as a whole, as Vygotsky envisaged it. Thus, when we look at students such as Davie, our activity theoretical approach helps us realize how in his regular classes, he is in control neither of specifying the object of his activity nor over the productive means. What he generates is qualitatively inferior to the things produced by his peers, although these are used as part of the evidence that has led to the ADHD label. On the other hand, in the environmental unit, others mediate the entire system in such a way that the practical activity in which Davie is involved exceeds those of his normally high achieving classmates. In this context, he also mediates the productions of others and thereby meaningfully contributes to both his and everyone else's learning. As a result, our ethnographic videotapes featuring Davie show little proof of what one normally associates with ADHD. An activity theoretical approach allows us to appreciate the seemingly anomalous observation that the same child exhibits behaviors that are aligned with the ADHD label in one type of class but are thoroughly inconsistent with it in another.

Dialectics

In his analysis of mind and its development through practical labor activity, Vygotsky embraced Marxist concepts (Davydov & Radzikhovskii, 1985). Yet in his lifetime, the philosophical basis for dialectical materialism was still in its infancy, which saw maturity only after his death by philosophers such as Evald Il'enkov (1974/1977, 1960/1982). We believe that the least understood and most violated tenet in Western interpretations of CHAT likely is the dialectical nature of consciousness, which includes cognition, memory, and personality, among others (Elhammoumi, 2002). This situation is unfortunate, because dialectics is "possibly the most appropriate frame of reference for the study of human development, and indeed was actually developed as an explanation for human development" (Glassman, 2000, p. 2). Dialectical approaches to theorizing activities thus offer new opportunities for units of analysis that are analyzed in terms of mutually exclusive category pairs, including individual-collective, body-mind, subject-object, agency-structure, and material-ideal; that is, the opposites are theorized as nonidentical expressions of the same category, which thereby comes to embody an inner contradiction. We accordingly use an analogy of threads, strands, and fibers to share not only dialectics in general but also a number of specific theoretical aspects of CHAT in this review.

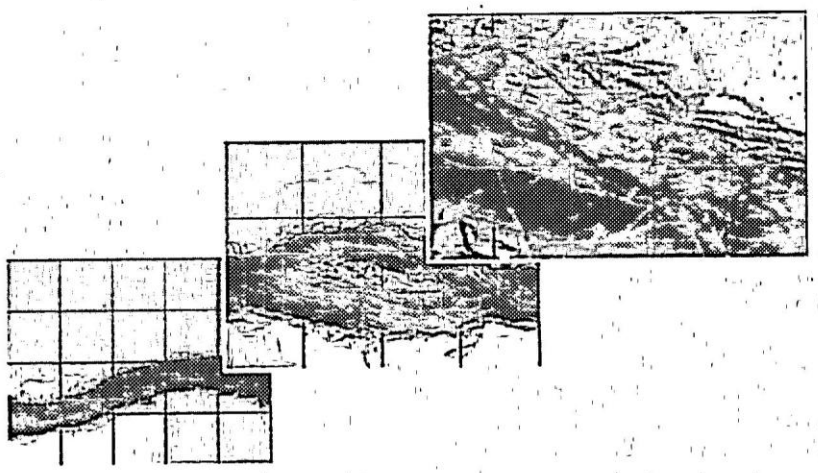

FIGURE 3. *Three microphotographs shown at increasing magnification from left to right showing the relationships between a thread, strands, and fibers.*

Saying that a relation is dialectical is equivalent to saying that any part that one might heuristically isolate within a unit *presupposes all other parts*; a unit can be analyzed in terms of component parts, but none of these parts can be understood or theorized apart from the others that contribute to defining it (Levins & Lewontin, 1985; Valsiner, 1998). Therefore, when one examines a thread, it assumes one form (Figure 3, lower left), though on moving closer, one may note that there are actually two or more interwoven strands (Figure 3, center). Without these strands, there is no thread, which thus presupposes the strands it is composed of. At the same time, the strands are what and where they are only because they are part of a thread; they assume a higher order structure that they contribute to realizing in a concrete way.

With greater magnification, one sees that the strands are actually composed of very short fibers (Figure 3, upper right). The strands again presuppose fibers, for without the fibers, strands would not exist. But similarly, in this configuration, the fibers presuppose the strand, for without it they may be functioning as something very different—as part of recycled paper or collage in an artistic work, for instance. In the particular contexts that a dialectical orientation attempts to explain, therefore, the specific function of individual components cannot be understood decoupled from the function of other parts and the function of the whole. Looking at a fiber, we cannot know what it does unless we look at its place within a larger system and at its relations with everything else. The characteristics of the thread cannot be deduced from the characteristics of the strands or fibers; the latter may be very tender or brittle, but the thread is very strong. Although the strands are very short, the strands and thread can be very long, exceeding the lengths of the former by many orders of magnitude. In the context of the environmental unit, the students are like fibers in a strand (the environmentalist community), itself a constitutive part of the thread (society). This analogy provides us with an initial framework for

understanding Davie's performances: In the environmental unit, he, a fiber, is thoroughly integrated and takes his place in a strand and thread, which in turn provide structures for what he does, which, as we describe, by far exceeds his solo performances in mathematics. Collective exploration also would probably allow Katherine's students to develop deeper understanding that direct teaching targeted at the individual mind.

Dialectical entities are understandably confounding, for in the wake of classical Greek thought, philosophy has evolved dualistic modes of expression, which do not permit contradictory entities. Thus, we conceptualize light in terms of wave or particle rather than saying that it simultaneously (a) is both wave and particle and (b) is not both wave and particle. Dialectical philosophers, on the other hand, realized that a theoretical category could not be a universal unless it also included its opposite (e.g., Hegel, 1807/1977); dialectical categories, however, can aspire to be categorical universals because they assert the mutual presupposition of opposites. To explicitly mark the dialectical nature of such categories, some recent publications have used special notation whereby two mutually exclusive but reciprocal terms are combined together (Roth, Hwang, Lee, & Goulart, 2005; Roth & S. Lee, 2004; Roth, Tobin, Carambo, & Dalland, 2005). These terms are separated by means of the Sheffer stroke |, which corresponds to the NAND operation in classical Boolean logic that creates statements that are always true when it involves nonidentical terms of the same entity. This approach leads to new categories—for instance, agency|structure—that encompass built-in contradictions. Understood in this way, "individual|collective" implies that individual and collective presuppose each other and that neither individual nor collective can be used as a theoretical starting point for explaining the other despite the latter dominating the educational literature presently. Thus, Davie turns out to be highly competent in the environmental unit, in which he is a fiber in a communal strand that he contributes to constituting; but as an individual fiber (in math class or the school psychologist's office), he ends up receiving the ADHD label and is administered drugs and other special treatments designed to "fix" his "disability." Without this breakthrough in dialectical reasoning, it seems unlikely that we would have been able to comprehend how complex, nonliving entities such as classrooms (McDonald, Le, Higgins, & Podmore, 2006), school departments (Ritchie, Mackay, & Rigano, 2006), and workplaces (Y.-J. Lee & Roth, 2007; Miettinen & Virkkunen, 2006) can perform seemingly individualized acts of learning like persons.

Analyzing Activity Systems

Armed with a powerful tool in dialectics at their disposal, activity theorists also use an "activity triangle" for revealing the social and material resources that are salient in activity (Y. Engeström, 1991a, 1999a). Characteristic of second-generation activity theory, Figure 4 is a widely used depiction of the mediated nature of these resources using the aforementioned environmental unit as a case in point. The figure depicting one concrete realization of an *activity system* contains all the theoretical terms that we introduced previously—*subject*, *object*, *means of production*, *division of labor*, *community*, and *rules*—and it contains the higher order processes of production, exchange, distribution, and consumption. Whereas scholars frequently use this representation as an icon to indicate their theoretical allegiance, it is best considered a useful heuristic, though one that is not totally devoid of problems (Roth,

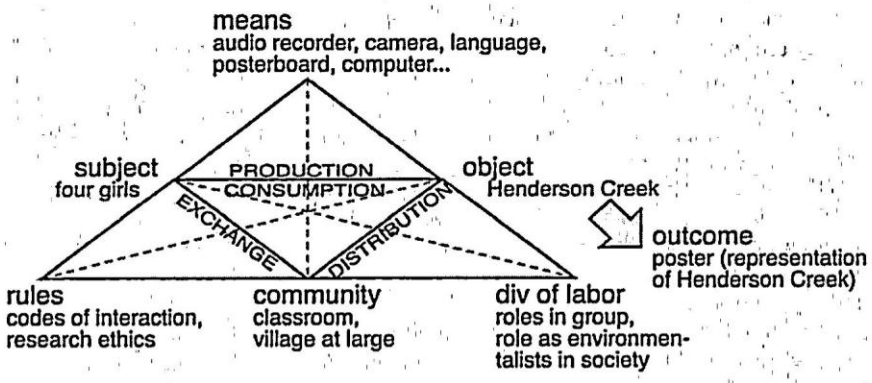

FIGURE 4. *A widely used second generation cultural-historical activity theory heuristic known as the "activity triangle" for analyzing an activity system. This activity triangle is exemplified using the environmental unit at Henderson Creek.* *Note.* div = division.

2004). German critical psychologists have also developed a parallel list of structures and actions in the study of praxis called the *praxis portrait* (Markard & Holzkamp, 1989). The latter is a list of items for guiding CHAT research in and on praxis that also explicates the fundamental ways in which research on practical problems ought to be conducted.

To elaborate on some fundamental aspects of CHAT used in the triangle heuristic, the term *activity* is not to be equated with relatively brief events with definite beginning and end points (characteristic of school-based tasks) but an evolving, complex structure of mediated and collective human agency. Thus, farming, commerce, dance, architecture, and, as a more recent form, mass schooling all are historical activities with objects and motives that contribute to maintaining human societies and, therefore, to maintaining individuals. With regard to the object of activity, it exists twice (Hegel, 1807/1977; Leont'ev, 1978): first as a material entity in the world and second as a vision or an image, both in its present state and how people envisage it in the future. Because the image is characteristic of human beings, it is evident that the "subject" cannot be coextensive with the material bodies of the girls in the environmental unit individually or collectively. The girls in the first group using camera and audiotape to represent the creek and their object can therefore not be theorized independently: What the relevant object is in actions and activities observed depends on who the acting subject is, and the nature of the relevant subject depends on the nature of the object (Lave, Murtaugh, & de la Rocha, 1984). Hence, learning is equivalent to the mutual change of object and subject in the process of activity; human beings plan and change the material world and societal life just as these settings mutually transform agents and the nature of their interactions with each other. Learning, which occurs during the expansion of the subject's action possibilities in the pursuit of meaningful objects in activity (Y. Engeström, 1991b), is thus evident in the vignette from the environmental unit.

Making education relevant by moving from objects of traditional school tasks to objects defined within society more broadly has been used not only in the design of the environmental unit featured here but similarly to promote higher order thinking practices across mathematics (Hershkowitz, 1999), science (Giest & Lompscher, 2003), and other school curricula (Hedegaard, 2001, 2002; Hedegaard & Lompscher; 1999).

In the same way, the four girls in the environmental unit and their productive actions cannot be thought independently of other entities that make their culture. For example, the outcomes of their actions depend on, but are not singularly determined by, the available means. The girls have chosen a camera and a tape recorder rather than a tape measure and a stopwatch, which shapes and is reflected in their product, the poster presentation. In CHAT, one speaks of the mediation of a relation, here subject-object, by another entity: the artifacts that embody the accumulated history of human ingenuity and creativity. In the triangle heuristic, there are other entities, such as the community within and for which some activity takes place, the division of labor that acts both internal to a subject (in the environmental unit, one girl operated the photo camera while others divided up the work of producing text recorded on audiotape) and within the community (e.g., teachers teach and bakers bake, but because of the division of labor in society, both groups of workers have to eat and get their children educated as part of the environmental unit). Finally, rules constitute an important resource for situated actions. All of these theoretical units must be understood as threads that make a strand or fiber, in the sense that the environmental activity as a whole would not materialize without the entities, but these entities appear in this configuration only because the activity is preexisting. That is, these entities and the activity they reference presuppose each other, which seems to be what many scholars partial to CHAT have foremost in mind when they explore cultural behavior holistically in what they call "activity settings" (e.g., Farver, 1999; Gallimore & Goldenberg, 2001). Without such an encompassing frame, we cannot understand why Davie does so well in the environmental unit generally and, for example, during the open house specifically (see also Figure 2).

Resources are available for use in action, but they do not function deterministically, much like a wild-water canoeist's plans guide his or her actions rather than determine his or her actual descent (Suchman, 1987). Furthermore, actions produce novel resources that become available for subsequent actions by others in the emergence of the social (Saxe, 1999). That is, the *outcomes* of actions become part of the newly transformed system that continues in like manner. We may read Figure 4 in this way: *Consumption* is the opposite of production: Others learn from the children's productions (Figure 4, center), and all outcomes of productive activity eventually get to be consumed. The relationship of individual subjects with others in their community is one of *exchange*. Objects are asymmetrically accumulated within a society, leading to differential *distribution*: In this village, environmentalists and stream stewards know more about the environmental health of the creek than the students, who in turn know more about it than most residents (Figure 4, lower right).

It is important to note that any material entity is not fixed but can take different functions within an activity system. For example, signs can switch functions and become tools in the process of reading texts that further generate new texts and meanings that are culturally and historically situated (Smagorinsky, 2001). By the

same token, mundane objects such as textbooks can continue their lives in other roles and assume diverse functions within the same or other activity systems (Y. Engeström, 1996). Thus, knowledge about biological (coliform) contamination of the creek (created by an eighth grade student) finds its genesis as an object of activity, moves on to become the outcome of the activity embodied in an exhibit at the environmentalist open house, and subsequently shifts its function to a *tool* when appropriated in political discourse to affect farming practices in the *community*, defines *division of labor* in the community (environmentalists versus farming and industry), and defines *rules* (new community bylaws regulating industrial discharge and cattle grazing practices [minimum grazing distance to creek]). From a CHAT perspective, human cognition thus is considered as situated and distributed across social settings and acting in concert with diverse, changeable artifacts.

Networks of Activity Systems

Third-generation activity theory endorses the fact that all activity systems are part of a network of activity systems that in its totality constitutes human society. Diverse activity systems are the result of a continuous historical process of progressive job diversification and collective division of labor at the societal level (Marx, 1867/1976). Thus, during societal development, some prototypical activity system as depicted in Figure 4 unfolds into two or more systems; the network is formed as activity systems lose their self-containment and exchange entities, including objects, means of productions, people, and various forms of texts. The first activity system is understood as a concrete universal, which particularizes itself into many mutually constitutive activity systems. Thus, the system of schooling produces graduates who enter the workforce; some workplaces, such as paper and scientific instrument companies, produce resources for the system of schooling, here the notebooks, stopwatches, and dissolved-oxygen meters students deployed in Henderson Creek.

As long as individuals contribute to one activity system, they sustain not only its output (production) and its (and their) own reproduction, but also to society as a whole because of the various exchange relations linking the different activity systems that make society (Y. Engeström, 1999c). This situation gives rise to the possibility for contradictions that transcend the individual subject and its relations to other elements in the activity system. In fact, students mediate between school and home as normally separate activity systems containing within- and between-system contradictions that experience resolution once both systems begin sharing ontogenetic histories (Takahashi, 2003). Of course, this mediation presents special challenges for educators who strive to minimize the distance with their students in terms of their life-history trajectories to cultivate meaningful instruction (Tobin, 2004; van Aalsvoort, 2004). Recent work undertaken by the Everyday Science and Technology Group (http://everydaycognition.org), based at the University of Washington, violates the common assumptions that school settings are the preferred or primary location for gaining competency in science, digital technologies, and argumentation practices among youth. What is needed is to recognize that the foundations of knowing are surely multisite ecologies integrating the individual, social, and whatever cultural tool kits are salient across the life span. Researchers who adopt third-generation activity theory hence make it a priority to ascertain the role of dialog, multiple perspectives, and issues of power when dealing with interacting activity systems as networks.

Activities, Actions, and Operations

CHAT offers additional theoretical lenses when it distinguishes three dialectically related levels of analysis: object- or motive-oriented activities, goal-oriented actions, and conditioned operations. According to Michael Cole (personal communication, May 1, 2004), these levels are often conflated, which leads to problems in appropriately theorizing the hows and whys of human behavior. These three levels relate to one another much as the thread, strand, and fibers in our analogy, respectively.

The term *activity* is related to work, trade, and professions: Leont'ev (1978, p. 46) likened it to the German term *Tätigkeit* (which has the synonyms *work*, *job*, *function*, *business*, *trade*, and *doing*) and distinguishes it from *Aktivität* (which has the synonyms *effort*, *eagerness*, *engagement*, *diligence*, and *restlessness*). The activity concept therefore differs from the kind of events educators usually denote by *activity*, which are structures that allow children to become engaged, involved, and busy and that one might better refer to as tasks. What Katherine's students in the opening vignette do are tasks; the students in the environmental unit participate in an activity that really and meaningfully contributes to the production and reproduction of society and its relation to the natural environment. Some scholars therefore reject the idea of learning as an activity system (Holzkamp, 1983), whereas others insist that learning can be planned and analyzed as activity system (e.g., Davidov, 1988; Lompscher, 1999). A snapshot of activities described in the CHAT educational literature include *redesigning* instruction (Jonassen & Rohrer-Murphy, 1999; S. Lee & Roth, 2003a), *planning* for teacher learning (Ball, 2000; Edwards & Protheroe, 2004; Grossman, Smagorinsky, & Valencia, 1999; Kärkkäinen, 1999), *providing* for learning or physical disabilities (Bakhurst & Padden, 2001; Daniels & Cole, 2002; Kosonen & Hakkarainen, 2006), and *managing* schools (Gronn, 2000; Spillane, Halverson, & Diamond, 2004); all these concrete activities, as true of activities in general, are characterized by the collective nature of their motives (Leont'ev, 1981). In the realization of collective motives, an activity system contributes to the survival of society and therefore the survival of each individual, in and through whose actions society is realized and exists (Holzkamp, 1991). The subjects of individual activity systems (individuals, groups, organizations) concretely realize collective (generalized) activity by adopting and realizing the general object or motive. Thus, doing environmentalism has a collective motive that exists in various forms in society, which the environmentalists in the community and the students in the seventh grade unit concretely enacted in one form.

An activity is realized through concrete *actions*, which are directed toward goals that are framed by individuals; in CHAT, actions and the goals they accomplish are the dominant features in human consciousness during active engagement with the world. In our example, taking photographs of Henderson Creek near a high school to document uncollected litter is one specific goal. The relationship between action (goal) and activity (motive) is dialectical, for actions constitute activities, but activities motivate particular action sequences. This relationship we denote as sense (McNeill, 1985), for in the context of a different activity, the same action has a different sense, much like the function of a woolen strand would be different if a bird used it to make a nest. The results of actions become part of the resources available in later stages of the activity for subsequent actions. Because the outcome of actions

cannot be anticipated with perfect accuracy, the contexts in which human beings act change constantly, whereas the overall motive (activity) may remain unchanged. The impossibility of perfect anticipation leads to the fact that goals and the actions that realize them have an emergent quality as the subjects of activity consciously choose them under the auspices of the overall object or motive to be achieved (Lave, 1988). Recall that Katherine has student learning as her overriding motive, although there are alternative actions available to her (e.g. student- or teacher-centered pedagogies) to fulfill the former.

Actions (goals) are referents for the sequencing of those unconscious elements that realize them: *operations*. An operation is shaped "not by the goal in itself but by the objective-object conditions of its achievement" (Leont'ev, 1978, p. 65); in other words, operations emerge in response to the relationship of goal and current state of the action and its material context. At Henderson Creek, one girl might have the goal to take a photograph that depicts pollution, but she does not have to consciously consider moving her head to find a suitable shooting angle or bending her finger to press the shutter button. Perceiving things lying around the creek as garbage and pressing the shutter button on the camera are examples of operations. Therefore, the relationship between actions (goals) and operations (conditions) is again dialectical, and they presuppose each other like strand and fiber, respectively, for a sequence of operations constitutes an action, but the action provides the referent for any operation and the sequence as a whole. This relationship is denoted by the term *reference* (Roth, 2006). By its nature, reference is associated with phenomena located in the human body and mind; *sense* is associated with phenomena in collective activity systems. Meaning, as we explain below, is denoted by this interplay between reference and sense and therefore comes to be embodied and cultural-historical simultaneously.

Distinguishing the three levels is "absolutely necessary . . . in the context of the psychological analysis of activity" (Leont'ev, 1978, p. 65), especially when considering *mediation* (Roth, in press). At the level of actions and activities, tools or division of labor are chosen consciously, therefore mediating the subject\object relation. At the level of operations, however, the tools become transparent: They are elements integrated into the human body (Bateson, 1972; Devereux, 1967). The camera a student uses is thus not an entity in itself, but the act of using the camera is of relevance to understanding conscious forms of knowing. When some CHAT researchers isolate tools as a separate analytic entity in the triangle heuristic, they face the threat of misinterpreting their data, because they do not attend to the different functional relations between subject, tool, and object (Suchman, 2000). Avoiding simplistic forms of mediated subject\object relations, some CHAT-based studies showed how tools apparently disappeared into the person concerning mathematical knowing and learning in the workplace (Roth, 2003a, 2005b), whereas others showed how tools undergo continuous transformation during instruction (Schwarz & Hershkowitz, 2001). Also called the repository of culture or "crystallized operations" (Leont'ev, 1978) that reflect and afford certain preferred patterns of culture, tools are made an object of consciousness only when they fail to perform, such as during a breakdown. Not to be taken negatively, these problem situations can in fact provide a valuable reflective stance toward the learning activity, as we explain next (Koschmann, Kuutti, & Hickman, 1998).

As in all dialectical units, activity systems harbor *inner* contradictions, which come with the coexistence of mutually exclusive elements. For example, in a development of a Vygotskian approach to mind, speech and gestures concurrently produced in interaction not only are mutually constitutive elements of the same unit but also are inherently distinct and irreducible to each other (McNeill, 1992). Here, speech and gesture relate like two fibers in a strand or wave and particle in light. They form a speech/gesture unit, each expressing the whole but doing so in very different ways so that they cannot be reduced (translated) to each other. Light expresses itself as a wave (e.g., when bent by a camera lens) or a particle (when activating a camera's light meter); but although both wave and particle are expressions of light, they cannot be reduced to each other. This formation creates a contradiction inside the unit, which then is responsible for the development of communication (McNeill, 2005). Recall also that the same object of activity exists twice, as material and as vision, thus taking very different, mutually contradictory forms.

When inner contradictions are conscious, they become the primary driving forces that bring about change and development within and between activity systems. Generally overlooked is the fact that contradictions have to be historically accumulated inner contradictions, within the things themselves rather than more surface expressions of tensions, problems, conflicts, and breakdowns (Il'enkov, 1974/1977). Subjects can experience contradictions in four types (Barowy & Jouper, 2004; Cole & Engeström, 1993; Roth, 2003d), depending on where they occur in the activity system (Figure 4). At a primary level, they may be internal to a fundamental entity, such as when the children's dissolved-oxygen meters malfunction or when a concept they use to calculate water flow is inappropriate; the inner contradiction of some object, like a cause, may *express* itself in the different symptomatic ways in which individuals actually experience and understand it. Coming closer to the lived realities of learners, performing well during achievement tests is another primary contradiction that sometimes uneasily mediates between learning for learning's sake or for earning (future) rewards. Failing to unpack or resolve this critical issue over the course of one's education may result in strategic choices for learning, including viewing school-based learning as a stepping-stone in the larger pursuit of happiness without much inherent meaning in itself.

At a secondary level, contradictions may exist between two constituent entities, such as when the demand for quality work in complex environmental problems (object) negates the school-based rule of completing curriculum in a fixed amount of time. What Katherine, the fifth grade teacher in the first vignette, experienced concerning the theory-praxis gap exemplifies this particular contradiction. At a third (tertiary) level, they exist between the object (motive) of the dominant and the object of a culturally more advanced form of the activity. An example of a tertiary contradiction is the difference in the object or motive of a regular seventh grade science class in the school (being able to memorize and define certain words related to water and environment) and the one that the students and two teachers in the environmental unit realized (generating knowledge about creek health). Likewise, when a teacher tried to implement problem-based learning in her high school biology class to encourage higher order thinking, impending high-stakes assessment modes and larger societal pressures severely curtailed the effectiveness of learning (Yeo, Tan, & Lee, 2006).

At a fourth and final level, trouble may exist between the central activity and one of its neighboring activities. An example of this situation was the new graduate from a teacher education program (System 1) participating in the Henderson Creek project (System 2), who was unprepared for but nonetheless required to teach seventh grade science, which is an integral part of the elementary school curriculum in British Columbia. By paying attention to these inner contradictions, analysts can therefore gain insights into how larger sociopolitical and economic struggles mediate local practices, subjectivities, and therefore learning among children (Göncü, 1999; Paradise, 2002) and adults (Holland & Lave, 2001; Y.-J. Lee & Roth, 2005).

Whereas inner contradictions reveal themselves only during analysis, they express themselves as trouble in ongoing activity. When such trouble is available to consciousness, it can be addressed by a change of goals (Barab, Barnett, Yamagata-Lynch, Squire, & Keating, 2002) or simply abandoning the introduced technology (D. L. Russell & Schneiderheinze, 2005), for instance. Thus, when the students measuring water speed using a Styrofoam ball found out that the wind was pushing the ball across the water surface, they floated an orange someone had brought, which, because of its weight, was unaffected by the wind. Otherwise, trouble can cause "workarounds," whereby human beings do things in unintended ways that nevertheless circumvent the trouble (e.g., Bannon & Bødker, 1991). The teachers in the Henderson Creek project also obtained their own teaching resources to make up for a lack brought about by the depletion of the science budget (for the worksheets colleagues in their school had consumed in direct teaching pedagogies). Here, the inner contradiction may be that characteristic of a class society and faulty policies, which expresses itself in the fact that schools serving poor and working-class students receive fewer (financial) resources than those in more affluent neighborhoods.

Contradictions, when they are brought to the level of consciousness, engender homeostatic processes within activity systems, which thereby change and develop over (historical) time. But because complex phenomena are nonlinear, change is unpredictable and nondeterministic, leading to the contingent nature of activity systems, including languages used, notions of selfhood, and communities (Rorty, 1991). Activity systems therefore can be appreciated properly only through structural (synchronic) and cultural-historical (diachronic) analysis (Gutiérrez & Stone, 2000; Scribner, 1985). Even human emotions and motivations can be understood only as integral aspects of human activity systems that are cultural-historical accomplishments at a general level (Tolman, 1994) although concretely realized in situated activity (Goodwin & Goodwin, 2000). Returning to our analogy, unfolding engagement in situated activities, personal biographies, and the histories of groups and societies stand in the same mutually constitutive relationships as fibers, strands, and thread. Research interrelating human development across microgenetic, ontogenetic, cultural-historical, and phylogenetic timescales (Cole & Engeström, 1993; Erickson, 2004; Lemke, 2000) is as yet embryonic, although one important study clarified how schooling (and society) "made" students within an urban community that was caught in the swirl of rapid political and economic change (Packer, 2000).

Collaboration: Enacting Learning and Development

CHAT has much potential for educators, because it is thoroughly about development and learning, encompassing the system as a whole and various subjects and communities that constitute it. Because everyone contributes to productive activity,

in whichever way this may be, they not only contribute to the ultimate reproduction of society but also increase action possibilities for themselves (Holzkamp, 1984b). Two manifestations of *expansive learning* arise from this interplay between individual and society. On one hand, learning is expansive when it contributes to an enlarged room to maneuver for the individual whereby new learning possibilities are formed. On the other hand, learning is also mediated by the division of labor in collaboration, which inherently leads to learning outcomes and forms of societal activity (Donato, 2004; Guberman & Saxe, 2000; Tolman, 1999). Learning occurs whenever a novel practice, artifact, tool, or division of labor at the level of the individual or group within an activity system constitutes a new possibility for others (as resource, a form of action to be emulated) leading to an increase in generalized action possibilities and therefore to collective (organizational, societal, cultural) learning (Putney, Green, Dixon, Durán, & Yeager, 2000; Raeithel, 1996; Roth, 2003b). Individual and collective learning are now linked by "*transgressing the boundaries of individual subjectivity* through immediate cooperation toward the realization of *common interests of collective self-determination against dominant partial interests*—intersubjective relations in a definite sense reflect collective or rather societal subjectivity" (Holzkamp, 1983, p. 373; our translation).

Collective work—of which that involving teacher-student or tutor-tutee interactions is but one kind—allowing new forms of actions, which are appropriated in what is termed the *zone of proximal development* (Vygotsky, 1978). The latter increasingly is used as a descriptor of instances of scaffolded teaching and learning situations from units as small as dyads (parent-child) to larger groupings such as classrooms (Kozulin, Gindis, Ageyev, & Miller, 2003; Shayer, 2003). Notwithstanding that it constitutes a possible misrepresentation of Vygotsky (Gillen, 2000; Leont'ev, 1981, p. 57) and a tough concept to implement (Daniels, 2001; DeVries, 2000), the zone of proximal development sometimes invokes a problematic internalization-externalization dichotomy.

For an individual, there are two forms of learning possible in the zone of proximal development, only one of which is normally made thematic. First, in collaboration, a less experienced person may observe a form of action and, by means of emulation (mimesis), learn to act in a more or less imitative ways; in this way, the children at Henderson Creek gain proficiency with the equipment from watching the biologists in the environmentalist group. Second, when two or more individuals collaborate, entirely new actions unfold: By dividing the work, two or more children are enabled to measure the width of a raging creek and thereby learn "to measure the width of a creek," which was impossible if they were working alone. The possibility of entirely new or more sophisticated actions in collective activity explains why individuals can learn even if they collaborate with peers at the same developmental level rather than with more advanced others (e.g., teachers, parents), such as the learning some have described to occur in computer clubs (e.g., Collins, Brown, & Newman, 1989).

This second dimension is closely related to a reformulated definition of the zone of proximal development as the distance between the actions of an individual and the historically new forms of societal activity created in collaboration (Y. Engeström, 1987). Collective activity not only increases the learning opportunities for students but also leads to learning to teach through implicit ways: the emulation of actions and practice of new forms of actions available in collective activity. It foregrounds the

socially contested nature of learning and has been explicitly used to set up advanced forms of teacher training through *coteaching*, a form of teaching in which two or more individuals teach together simultaneously, enacting full responsibility for all parts of the curriculum (Roth & Tobin, 2002; Roth et al., 2005). Thus, the environmental units, which involved not only the two teachers but also other individuals from the community, gave rise to many learning opportunities on the part of all those participating in teacher roles: regular teachers (e.g., Roth & Tobin, 2002, chap. 1), teaching interns (Roth, Masciotra, & Boyd, 1999), environmentalists (S. Lee & Roth, 2003b), students (Roth & S. Lee, 2004), and parents (S. H. Lee & Roth, 2003c).

Some educators have fruitfully exploited this collectivist interpretation of the zone of proximal development to bridge issues of diversity in classrooms. These approaches have in common a strong commitment to dialog and the production of hybrid spaces that foster mutual understanding (Cole, 1998). Of interest here is the focus on the intersection of teachers' and students' cultural, discursive, and knowledge resources that offer opportunities for shared learning. These unstable and ephemeral spaces for going beyond what counts as knowing promise much for encouraging low-achieving students, such as Davie in his mathematics classes, who have been marginalized by current school practices or even peer groups (Diamondstone, 2002). These pedagogies eschew ascribing stability to cultural ways of knowing and issues of diversity in classrooms. Instead, differences in ability are attributed to learners' participation in specific cultural-historically situated activity systems rather than being blamed on disadvantage and deficits (Gutiérrez & Rogoff, 2003) or narrow conceptions of competence (Gipps, 1999). For example, there has been ongoing research with Bakhtinian forms of discursive practices, or what is called "third spaces" (e.g., Gutiérrez, Baquedano-López, Alvarez & Chiu, 1999; Gutiérrez, Rymes, & Larsen, 1995), while others who work with African American communities have capitalized on the normally undervalued funds of knowledge that these learners embody (e.g., C. D. Lee, 2001; C. D. Lee & Majors, 2003; C. D. Lee, Spencer, & Harpalani, 2003; Majors, 2003). Alternatively, research in technology-intensive learning environments allows students to interact in model activity systems such as Michael Cole's Fifth Dimension (Cole, 1995, 1996; Nicolopoulou & Cole, 1993), Kris Gutiérrez's Las Redes (Gutiérrez, Baquedano-López, & Tejeda, 1999), and Sasha Barab's Quest Atlantic program (Barab, Hay, Barnett, & Squire, 2001).

Rethinking Attendant Educational Issues

CHAT has been used to address important educational issues in fresh ways, chief among which is language, which is perhaps the paramount tool, medium, and object in educational practice. We describe in the next section how aspects of language, language learning, and literacy can be reformulated according to CHAT. Of direct relevance to educators, CHAT too has always been a theory grounded in and emerging from praxis so that it aspires to be a theory *for* praxis.

Language, Language Learning, and Literacy

One consequence of using CHAT is an alternative way in which language, language learning, and literacy can be appreciated, understood, and explained. From a cultural-historical approach, language appeared later in human development, when collective activities such as hunting, division of labor (Leont'ev, 1978, used an

account of hunter-beater cooperation), tool production and use (among chimpanzees), exchange relations, and other cultural aspects of human life-forms already existed (Roth, 2003b). Language therefore is a category *subordinate* to activity (Leont'ev, 1971), with the consequence that words accrue to meaning (given by an activity system as a whole) rather than the other way around (Mikhailov, 1980). Thus, with respect to the environmental unit, we cannot theorize students' language and literacy development independent of environmentalism, the activity partially realized in and through the deployment of language and literacy as the means.

Educational researchers concerned with language, language learning, and literacy often ground their work in CHAT and most frequently in reference to *Thought and Language* (Vygotsky, 1934/1986). There is, however, a confusing array of approaches, largely because language and literacy are treated sometimes as tools for the transmission and construction of culturally accepted knowledge (e.g., Pontecorvo & Girardet, 1993; Wells, 1999; Wells & Claxton, 2002), sometimes as action (McNeill, 1985), sometimes as practices (e.g., Hanks, 1996), sometimes as mediating element constituting context (Doehler, 2002; Wake & Williams, 2001), sometimes as means to constitute both topic and terrain of interaction (e.g., Gutiérrez, 1994; Jacoby & Gonzales, 1991), sometimes as part of voice understood as communicative action (R. Engeström, 1995). The issues become even more muddled when the unit of analysis, activity, changes in scale from a collective (societal, historical) dimension (Boag-Munroe, 2004) down to school tasks (Varelas, Pappas, & Rife, 2005) and even parts of tasks, such as questioning and examining during pediatric consultation (e.g., Junefelt & Lindberg, 1995).

Language, language learning, and literacy find a proper place within CHAT when the latter is allied with speech act theory. This integration is made possible because of the central role actions (acts) play in both theories. A speech act has productive, intentional, and outcome components (Austin, 1962); as such, the speech act constitutes a legitimate form of action according to CHAT (Leont'ev, 1971). Similar to other actions, speech acts are constituted by components (operations) that conversationalists do not consciously choose; appropriate words emerge in response to the unfolding utterance by means of which the speaker attempts to achieve communicative goals (Roth, 2005c).

Furthermore, the sense of a speech act is a function of the activity system as a whole: Thus, the utterance "I won't do it!" lacks a sense in itself; rather, its sense properly emerges in its relation to the activity in its entirety. Assuming a student uses it in response to a teacher's request "Get your textbook out," the sense and consequences are altogether different than if it were the response to the admonition "Don't fight during recess." In the first case, the action undermines the teacher's authority, whereas the action affirms this same relation in the second. One observes that the teacher actually does two separate things with the same speech act: *requesting* and *admonishing*; the sense of the student's action, correspondingly, is very different though it looks the same: *refusing* a request and *acceding* to the admonition. Both choose their actions with respect to the activity system as a whole. The choice of a speech act is clearly a function of "the totality of all external influences on an organism extant in the situation, which, together with the motive of activity, completely inform the organism about the choice of that action, which best corresponds to the present motivation" (Leont'ev, 1974, p. 39; our translation).

At any rate, language is used *for* action; the selection and order of words does not require consciousness or reflection. The unfolding utterance (action in pursuit of goals, which may only form in concrete ways in activity) provides the context for the next speech operation (word), which normally is not chosen consciously (Leont'ev, 1971). In this instance, language can be said to serve as primary artifact (Wartofsky, 1979), functioning instead much like a cane in a blind person's hand. Language can also be *about* action, such as when the teacher and student discuss the first exchange and the consequences that might follow. Now, the utterance and the language is an object of attention and therefore a secondary artifact, a way of representing a previous moment of praxis. Language can also assume the form of a tertiary artifact when teachers generate theories *of* practice, which can be more or less independent of praxis (Hoffman-Kipp, Artiles, & López-Torres, 2003). We return to this issue in a subsequent section.

Taken together, these three functions of language mirror the levels of analysis in CHAT. At the level of operation, language (choice of words, grammar) is unconscious. When language is viewed as action, it becomes an explicit tool (e.g., reflecting on action, representing situations), sign, or object. Finally, at the level of activity—theorizing teaching—it also may function as tool, sign, or object. Because in use, language can function as tool, sign, and object—being in each case materially embodied—it can switch its position in the activity system with ease (Figure 4). This close association of language and CHAT has spawned a few CHAT-based models of learning (Gal'perin & Leont'ev, 1974): acting with material objects, acting in spoken language, and acting in consciousness. Engagement with material entities plays an important role that first has to be translated into concurrent articulated speech, which eventually ceases, leaving only inner speech. Nevertheless, even in its utter privacy, inner speech makes use of language, which is not the one of the speaker, making this form of thought an utterly social action (Mikhailov, 1980). Naturalistic observations in science lessons bears witness for these transitions from active engagement with materials, pointing gestures replacing verbal explanations, to the emergence of articulated speech and symbolic hand gestures, to full dependence on scientific language (Roth, 2003c; Roth & Lawless, 2002). Again, one observes language first appearing in its function *for* action prior to being *about* action and situation, which in turn is prior to scientific explanation (theorizing).

Another aspect of significance is the work of Soviet psychologists regarding the internalization of action, especially speech, initially articulated in *Thought and Language* (Vygotsky, 1934/1986) and subsequently taken up in works such as *Language and Cognition* (Luria, 1981). Scholars in language learning who ground their research on these studies unwittingly maintain a dualistic opposition between inside and outside, between the intra- and interpsychological dimensions of learning and human interaction (see Lantolf, 2006). What is overlooked is the notion that language learning as pure acquisition is a "wrong" theory, for it is a dialectical process involving both inside and outside (Jäger & Küchler, 1976). Recent dialectical materialist interpretations insist that all (language) action has both inner and outer elements (Sawyer, 2002; Zinchenko, 2001). Recall that the sense of a (verbal) action exists solely in the action-activity relation, that is, from the social and therefore interpsychological situation, whereas the speech act is realized by operations, which, inherently, emerge on an intrapsychological plane. The sense

of an utterance hence presupposes the activity that encompasses the individual speech act (Keseling, 1979) by means of which the activity is (in part) concretely realized.

This interplay of activity and action, often forgotten, has been shown to influence the processes and products of research on scientists' knowing graphs and biographies. Both the forms of knowing and the biographies that emerged were the outcomes of the interviewer-interviewee interaction in particular and the activity system (social science research) in general (e.g., Roth & Y.-J. Lee, 2004). This study further confirmed that the production of communication begins with a growth point: an idea in the form of a dialectical unit of speech and image (McNeill, 1985). The communicative action, propelled by the inner contradiction in the speech-image unit, unfolds, recognizable in its repeated appearance in the form of a *catchment*, until the idea has been articulated and a (momentary) endpoint has been reached (McNeill, 2000). Here, semantic and syntactic rules, rather than constituting plans to be followed and implemented, provide speakers with stop orders: An utterance is complete once it conforms to the speakers' growing intuition of grammatical completeness and conformity to these rules (McNeill, 2005). Each time language forms are realized in new ways, they become available at a collective level, and parts of culture are created anew (Holland, Lachicotte, Skinner, & Cain, 1998), leading to a continual transformation of culture.

To elaborate further, the structure of the language preserves the system of human practical actions with objects (Mikhailov, 1980). As in pragmatic theories of language (Davidson, 1986), language reproduces the structure of the actual life of society, so that the boundary between mastering a language and knowing one's way around the world has been erased (Rorty, 1989). Some authors therefore suggest that language ought not to be considered an artifact or tool but a form of activity; meaning already exists as the totality of the activity system (Rocha & de Carvalho, 2000). The individual always learns and uses the sense of a word in the process of participating in activity; where he or she encounters its material envelope (sound) as an invariant property. Like other material tools and artifacts, the sense of a word or utterance arises from the relationship between action (goal) and activity (motive). Using a certain sound (word) means pursing a certain goal. Language as a system reflects social life, but in a metonymic relation: "language taken in relationship to the signified reality, is only a form of its being, just as are those material brain processes of individuals that realize its perception" (Leont'ev, 1978, p. 79). Thus, much like persons learn to use tools, tinkering, trying this or that way, students learn words through using them in particular situations defined by the object, division of labor, and community (Roth, 2005c), discarding some, retaining others. This unproblematic relationship between words and language or rather literacy (*parole*, speech) is like the relation between hammer and hammering. Pedagogical implications of how knowledgeable agents speak and act effortlessly within social worlds extend to second-language-learning research, whereby attention is now focused on the cultural dimensions of language study in which the processes of learning and identity go hand in hand (Lantolf, 2000). Likewise, activity theorists blur the traditional separation of texts, readers, and contexts when they encourage students of literature to go beyond the examination of literary characters' dialog, emotional states, beliefs, or goals. The way to respond to literature is

to holistically engage with texts as a cultural activity in tandem with the cultural worlds or activity systems that the texts signify (Galda & Beach, 2001).

One early study attempted an explicit integration of language into CHAT (R. Engeström, 1995). Accordingly, the social group of the speaker constitutes the community with its specific social language. The current speaker, drawing on words as mediating artifacts, aims at previous utterances (object) to voice (action) a new utterance as an instance of social language (outcome): Language is both a means and product of communication (Leont'ev, 1978), and it may be simultaneously tool and contested terrain (Roth & Barton, 2004). The speech genres are forms of rules at the level of operation that govern the speech act.

Theory for *Praxis, Praxis of Theory*

One of the most attractive features of CHAT for educators is that it lessens the theory-praxis gap due to the historical primacy of material, work-related activity over language and theory. Indeed, CHAT has been promoted as a developmental theory, for it seeks not only to explain but also, and more important, to influence qualitative changes in human praxis (Y. Engeström, 1999c). Activity theorists believe that human beings are not merely at the mercy of extant institutional contexts but that they are endowed with the power to act (agency), which allows for critique and revision. However, theory has left praxis wanting in two ways: through its inability or unwillingness to provide appropriate means for the analysis of praxis and through its downgrading of praxis to a second-order form of knowing (Holzkamp, 1988).

Actions are always theoretically grounded in the sense that practitioners normally anticipate the results for their actions, which are linked to practical reasons for acting (Ricœur, 1991). The latter derive from the sense that people make *in* their activity system (praxis), though they often fail to appreciate the structural (societal) relations that energize the activity system with its generalized motive (Dreier, 1980; Holzkamp, 1984a). Uncovering this influence necessitates a thorough interpretive analysis of historical determinants that lie outside the immediate life world of individual social actors (Smith, 1990). This larger canvas of active individuals (and researchers) embedded in organizational, political, and discursive practices constitutes a tangible advantage of second- and third-generation CHAT over its earlier Vygotskian ancestor, which focused on mediated action in relative isolation (Daniels, 2004a; Moll, 2001).

The environmental curriculum was designed on the basis of the teachers' understanding of CHAT and *real societal* activity as mediating cognition and learning. Thus, school tasks normally reproduce schooling, resulting in students getting good at doing schooling; participation in environmentalism, on the other hand, allows students to get good at doing environmentalism and thereby develop knowledge and skills relevant to society. In reviewing the literature, we have found three other basic forms of praxis-oriented research that explicitly claim allegiance to CHAT and its dialectical materialist backbone: the *change laboratory* (e.g., Virkkunen & Ahonen, 2004) and the *boundary-crossing laboratory* (e.g., Y. Engeström, 2000a) both have their origins in and are practiced at the Center for Activity Theory and Developmental Work (Helsinki, Finland), whereas the *coteaching/cogenerative dialoguing* model emerged from and was developed in the teacher education program at the University of Pennsylvania (e.g., Tobin & Roth, 2005). Because "activity theory is at its best in

analyzing poorly understood processes of developmental transformations over time" (Y. Engeström, 2000b, p. 308), all practitioners here are involved with researchers and facilitators in comprehending and theorizing work (instructional) practices for the overt goal of redesigning praxis. The first two programs appear united by the fact that participants largely come from within the activity system of concern, whereas in the third, professionals of very different ilk and geographical and social locations create teams, thus necessitating *boundary crossing*, to redesign the ways in which their various actions interface. By examining what these innovations in best practices have to offer, educators will gain much food for thought in redesigning teaching and learning.

Change Laboratory and Boundary-Crossing Laboratory

Change laboratory denotes a method for developing work practices on the job, in a room or space set aside where practitioners do the analysis and development *for* practitioners, typically involving a natural team or work unit, but still close to the members (Y. Engeström, Virkkunen, Helle, Pihlaja, & Poikela, 1996). The idea is to arrange space on the shop floor or in the school where there exists a rich set of instruments (e.g., a VCR, digital video, editing software) for analyzing disturbances and troubles and for collectively envisioning new models of work practices. This facilitates both intensive, deep transformations and continuous incremental improvement of practices: learning in a broad sense, or what has been called an expansive visibilization of work (Y. Engeström, 1999b).

In one instance, a change laboratory was convened to deal with the problems articulated by the teachers of a middle school serving a disadvantaged area in Helsinki, Finland (Y. Engeström, Engeström, & Suntio, 2002a). The researchers had identified three main predicaments for the dysfunctional school: (a) teachers' "weak knowledge" of students' homes and backgrounds, (b) careers after graduation, (c) and the poverty of the school. The teachers framed the issues in terms of a war against apathy, peaceful time for collaborative planning and preparation, and change in students' manners. Together, researchers and teachers, unconcerned with the differences in problem framing, traced the historical roots of the attendant problems and then moved to model (using the CHAT triangle [Figure 4] as a heuristic), current activity, and the existing contradictions. Vital in the successful school transformation was teachers' redefinition of students from "apathetic" to "competent," which required them also to change their stance from viewing students as controlled to trustworthy learners. This redefinition became the new object of the activity in the change laboratory. The participants then designed a major student project that turned out to change the ways in which students could realize their potential; as a consequence, teachers began to talk in more positive ways about the students. Both kinds of interventions then produced improvement in school climate.

On the basis of their successful change efforts, the teachers of the same school later arranged for a second change laboratory to deal with their instructional practices. The object of their change laboratory work was to create a sustained movement that turned available information and communication technology into a situated and locally grounded means for bringing about pedagogical change (Y. Engeström, Engeström, & Suntio, 2002b). The object or motive of their intervention was an attempt to debunk two related myths: that students "lacked basic skills" and were "unmotivated to produce original work." By integrating computer technology, which

they had resisted initially, teachers were able to enact a second set of solutions that improved the school even more.

Boundary-crossing laboratories are similar to change laboratories in their joint focus on the identification of contradictions and trouble and in the design of new practices that practitioners find acceptable. When the change laboratory involves practitioners from very different fields, the work in a change laboratory takes on a new dimension. In their work in the Finnish medical system, researchers often found that the care for patients with multiple illnesses involved professionals from different parts of the health care system, which required communication and cooperation across disciplines in primary and specialized care (e.g., Y. Engeström, 2001; Kerusuo, 2001). Working across boundaries and assembling people and, in fact, tying otherwise separate systems of activity together require a new form of collaborative work, *knotworking* (Y. Engeström, Engeström, & Vähäaho, 1999). Because these knots are tied and untied as the case requires, the knots themselves have to become the focus of analysis, and, importantly, knotworking becomes an activity system in its own right.

Coteaching|Cogenerative Dialoguing

In the coteaching|cogenerative dialoguing model, change interventions are brought about as university researchers, supervisors, administrators, evaluators, and methods teachers participate not only in the redesign of curriculum practice but also in the actual teaching. In fact, the practitioners of the model do not allow others to simply observe classrooms but require anybody wanting to know how the praxis works to engage in teaching. This criterion inherently increases the social and material resources available for learning on the part of students and teachers, irrespective of their prior experience. Thus, through coteaching, all stakeholders learn subject matter and subject matter pedagogy (Roth & Tobin, 2001; Roth, Tobin, Zimmermann, Bryant, & Davis, 2002; Tobin & Roth, 2002). It is a way of grounding theories in praxis and making them available for practical purposes (Roth & Tobin, 2004) that leads to development in a way that has also been reported to occur for psychosocial professions more generally (Dreier, 1989). Each time the environmental unit was implemented, two or more individuals cotaught the lessons, taking coresponsibility for all aspects of the lesson: planning, organizing the involvement of nonschool participants (parents, First Nations elders, environmentalists, biologists), and making sense after a lesson of what had happened.

Much of the learning in coteaching appears through implicit ways. During *cogenerative dialoguing*, on the other hand, participants in a classroom event meet after the lesson to share their ways of understanding past experiences, a valuable process of reflection on action. In these meetings, all participants contribute to the emerging understanding and theories of practice, and a checklist is elaborated to monitor these sessions so that individual voices are not silenced. Because individuals not normally part of the school structure are involved from the coteaching encounter, cogenerative dialoguing has a lot in common with knotworking, requiring the identification of common ground, language, and mutual respect for the variety of experiences, competencies, and structural positions that participants bring to the setting. As a by-product of this practice, high school students and teaching interns often copresent at international conferences and coauthor scholarly articles (e.g., Roth, Tobin, Carambo, & Dalland, 2004; Roth, Tobin, Elmesky, et al., 2004). We conceive of coteaching|cogenerative dialoguing as a dialectical unit: Cogenerative dialoguing

presupposes the joint experience in the classroom; changed practices in the classroom presuppose cogenerative dialoguing (Roth et al., 2000). At the same time, it is acknowledged that any knowledge developed *about* praxis, even if it is in terms of the personal and positioned voices of the participants, cannot ever be identical with praxis and practical knowledge, which only comes to be enacted in situation. It is this distinction between knowledge *in* praxis and knowledge *about* praxis that the practitioners of the model advocate in the copresence of all stakeholders in both forms of events.

Reflexivity

Theorizing (praxis) is itself a practical activity and can therefore be analyzed using CHAT, but the tools and motives will differ from the original practice, leading to a reflexively related set of activity systems in which the participants may or may not be the same. In teaching, student learning is the primary motive; teachers use whatever language is appropriate to facilitate student learning. In the change laboratory and cogenerative dialog sessions, their normal activity is the focal object, and the intended outcome is new understanding and designs for change. Here, language is used as a primary and secondary artifact. When researchers describe the secondary activity and changes in the primary activity, they use forms of language appropriate to an academic audience; they also draw on theories that may not have any relevance to the practitioners themselves. Here, then, yet another activity system takes the two previous ones as object (Roth, 2005a). Although the change laboratory is grounded in CHAT, and past projects using the triangle representation were deemed useful, it is beginning to surface that its attendant framework as depicted in the hierarchy of triangles representing sundry forms of activity is not easily grasped by participants (J. Virkkunen, personal communication, October 27, 2004).

New Avenues for Educational Research and Praxis

Besides reframing entrenched problems and ways of thinking about teaching and learning, new educational theories should evoke the imagination for generative research and praxis. The scope of any review article is too limited to present a complete manual of the possibilities ahead from CHAT research, but we sketch some likely avenues in the psychology of learning and educational praxis.

Research in the Psychology of Learning

Activity theory holds much promise for sharpening our thinking and praxis across three interrelated topics in learning research: motive or motivation, emotion, and identity. These concepts are, as Vygotsky (1934/1986) realized, integral to cognition, knowing, and learning, not some independent or peripheral factors that affect cognition. These phenomena and concepts therefore cannot be understood apart from individuals engaging in concrete social activity, which posits addressing them in a dialectical manner.

Motive or Motivation

Fundamental to activity theoretical research is the notion of motive, which, together with the category of emotion, makes superfluous all the "confused concepts and terms that characterize the present condition of the problem of motives" in psychology (Leont'ev, 1978, p. 116). Thus, when students are judged to be

unmotivated, they really are following differing objects or motives from those officially sanctioned from a CHAT perspective. At other times, educators view motivation to be displayed when students do what they (educators) want them to do; that is, the phenomenon becomes an internalization of the external locus of control. At its most fundamental level then, simplistic conceptions of motivation are pervasive whereby learning activity is "subordinated to the principle of maximizing positive and minimizing negative emotions" (Leont'ev, 1978, p. 120).

Motivation in any activity properly involves a degree of control over the object (Lompscher, 1999); the prospects of expanding control and action possibilities has positive emotional valence, leading students to buy into and realize a particular activity (e.g., environmentalism). The students in the environmental unit learned in the course of doing something that contributed to the common good (itself associated with positive emotional valence) and they expanded their action possibilities (i.e., learned) whenever they realized that a new skill or tool would allow them to expand what they could do. Historically, the relation between motivation and control over the object has evolved from needs that were the primary conditions determining what the subjects did. In most educational contexts, however, the freedom to pursue relevant objects—such as the seventh grade students, who choose what they do with respect to the creek and how they implement their plans—is not apparent, nor are the goals and actions of particular tasks independently established. This situation encourages a particular shape to consciousness, cognition, knowing, learning, identity, and all the other aspects that are produced and reproduced throughout the course of participation in learning activity.

Imagine what were to happen if teachers and students enjoyed greater freedom over the choice of objects or motives in their learning. Such an exceptional situation could take the form of deciding in which watershed-related activity system the students would participate, how to realize a particular object or motive (researching or contributing to farming, environmentalism, or industry), selecting appropriate goals, tools, divisions of labor, and so forth. An educator might now wonder, "How does the object or motive mediate the activity realized by students?" "What and how do students learn about water-related issues when they participate in farming versus doing environmentalism?" "How do the respective forms of dividing work mediate knowing, learning, and identity?" If Lave and Wenger's (1991) contention that mainstream educational systems have favored the exchange value of school grades over their use value is true, allowing students some choice in the objects or motives of their learning might bring educators some way toward rectifying this dilemma. The overlap between individually realized and societal motives is an important consideration for educators because it mediates between cognitive and emotional processes to which we now turn (Holzkamp-Osterkamp, 1977).

Emotion

Emotions are integral to the functioning of the activity system as a whole, for they "reflect relationships between motives (needs) and success, or the possibility of success, of realizing the action of the subject that responds too these motives" (Leont'ev, 1978, p. 120). Yet most educational research disconnects emotional from cognitive issues. Although the pioneers of activity theory always have taken emotion as an integral component, and although there is evidence of the central role emotion plays in mathematical and scientific cognition (e.g., Roth, 2007) and

teacher education (van Huizen, van Oers, & Wubbels, 2005), present users of CHAT do not customarily attend to this aspect. In CHAT, emotion is reinforced at both meaning-determining levels, that is, at the core of the activity|action and action|operation dialectics. On the one hand, there are aspects of emotion that "are relevant to activity and not to actions or operations that realize it" (Leont'ev, 1978, p. 121). Increasing one's possibilities in the world and control over one's life conditions—learning in the broad sense—are associated with positive emotional valence. The subject receives successes and failures with respect to the chosen motive positively or negatively, but the possibility of success shapes the way in which the subject engages in activity. On the other hand, current emotional states constitute a context for the selection of meaningful actions and the operations that realize them, but actions also feed back and mediate emotional states. While acting, these emotional states are latent in consciousness but are exhibited nevertheless, for example, in prosody: speech intensity, pitch, pitch contours, speech rates (Pittam & Scherer, 1993). Finally, during cooperative work that is so much part of any teacher's instructional repertoire, individual and collective emotions are two sides of the same coin, so to speak: Individuals exhibit emotions in their actions, which supply cues and traces for other people who may reproduce them and therefore contribute to a collective emotion (Collins, 2004).

Educational researchers may come to appreciate that emotions are always tied to the motives and goals of learning, which require in situ study: asking individuals in clinical situations, which usually have a different object or motive than the activity of primary interest, elicits peculiar emotions and emotional valences from other activity systems. With respect to the environmental unit, one might ask the following questions: "How does the activity system in general (e.g., farming, environmentalism) and the overlap between individual and collective motives in particular mediate emotions?" "How do emotions mediate the participation in activity (e.g., farming, environmentalism)?" "How do emotions mediate the selection of goals and actions?" "How are the emotions shaped by the concrete actions of realizing the learning activity?" and "How do individual and collective object- or motive-related emotions mediate one another?" For example, does engagement in an activity such as environmentalism lead to a different sense of feeling good, having contributed to the collective well-being, than contributing to the production of food?

Identity

During the pursuit of the object, subjects not only produce outcomes but also produce|reproduce themselves (Wenger, 1998). By extension, the changed modes of participation in social practices—learning in a broad sense—presupposes both what we *become* and how we *act* as knowers. Whichever identities are salient for an individual during a particular context exist in a complex dance with one's sense of agency and position within the social world. Besides bringing about some change in the world, human agency also provides others and self with resources for making attributions about the kind of person one is. Within school, students exhibit multiple identities, such as Davie, whose actions led to an assessment of ADHD, whereas his observable competence at Henderson Creek led the researchers to another conclusion. Identity is evidently a dialectical feature: It is continuously produced and reproduced in practical activity, which both presupposes and produces

identity (Roth, Tobin, Elmesky, et al., 2004). Instead of being an invariant attribute, the identities of subjects, who we are with respect to others (community), are co-constituted with and by the social and material resources at hand, according to activity theorists (Stetsenko & Arievitch, 2004). This formation of identity occurs in part through the constant slippage of artifacts between their material and virtual aspects that demarcate social space and positions (Leander, 2002a, 2002b; Penuel & Davey; 1999). Not that changing from one activity system to another and the concomitant negotiations of identity will be smooth, as beginning teachers, for instance, realize the world over when they graduate from college to their first teaching assignments. The key to the growth of a satisfying teacher identity is apparently achieved through an intellectual resolution mindful of social contexts rather than one of mere accommodation or acquiescence to (trying) circumstances on the job (Smagorinsky, Cook, Moore, Jackson, & Fry, 2004).

Much remains to be discovered about learner identities such as gender (Chandler-Olcott & Mahar, 2003) that emerge from participation in online worlds, including gaming and blogging communities. As a "residue," (auto)biographies, in which people recount what they have done in their lives, constitute the persons as particular characters appearing in different life plots (Wortham, 2003). This more stable aspect of identity is dialectically related to the dynamic aspect, though aspects and even entire biographies may be contingently reconstructed in and following specific events and participation in institutional life (Gee, 2001).

Despite being difficult to operationalize, another area of interest is the notion of collective identity such as that of a school or classroom. Personal identity and organizational or group identity are, depending on the theoretical framework taken, connected in some form, though the exact nature of this relationship is still undergoing much debate (Pratt, 2003). Again, CHAT can offer some tentative steps forward because of its dialectical core, which affirms that collective identity is always a structural feature of organizational life. Hence, a child who insists on creative acts of rebellion during instruction time is as much a constitutive member of that classroom and its collective identity as another who is a model student. This unlikely situation arises from the dialectical relation of individual subject and collective, which is asserted simultaneously with every action that concretely realizes the current activity, in this case "being a student" (Roth, Hwang, et al., 2005). When more work is done to uncover the role of emotions in identity, it is hypothesized that one can look forward to better nonreductionist explanations for understanding identity and the cognate notion of identification.

The students at Henderson Creek thus accomplished two things: producing themselves as active participants and learners within the environmental movement while realizing greater collective agency or competency than they could have achieved as individuals. Similarly, the professor who participates in teaching the unit also reproduces himself or herself as an individual who "does community service," and a mother who contributes to driving the children or teaching a group not only contributes to making the environmental unit possible but also reproduces herself and is acknowledged as an "involved parent." Parents' involvement in their children's schooling, in this light, should now be reconceptualized not just as a laundry list of things to do but rather an essential ingredient of the complex ecological process that leads to children's identity formation in and out of school (Barton, Drake, Perez, St. Louis, & George, 2004).

In the context of the environmental unit focusing at Henderson Creek, one might ponder, "How does participating in environmentalism mediate the formation of identity?" "Are particular types of identity developed in preference over other?" Because students move between overlapping activity systems, we may ask, "How do students tie these different identities—perhaps in a new activity system where the 'knotworking' connecting the two preceding activity systems is done?" Seventh grade students already have an experiential history and an identity stabilized in their early forms of autobiography. We might contemplate, "How do existing identities mediate the participation in activity and, therefore, the production and reproduction of identity in ongoing activity?"

Educational Praxis

Adopting CHAT as a guiding framework allows for a questioning of the structural determinations of current educational practices. As argued in "Theory *for* Praxis, Praxis of Theory" above, when stakeholders themselves have opportunities to participate in determining their teaching and learning settings, it permits greater control over aspects of their life conditions and the expansion of action possibilities in personally relevant ways. In a nutshell, it would stimulate a greater congruence between individual and collective motives, resulting more often than not in win-win situations. At the same time, we expect significant resistance to this suggestion as normally localized decision-making powers diffuse downward to collectives. Where these educational experiments have occurred, as in some French secondary schools (e.g., Lycée autogérée de Paris, http://www.l-a-p.org/), higher rates of success were experienced, especially among those deemed failures in the regular school system.

It is also common knowledge that out-of-school activity systems are relatively stable, changing slowly across historical time. Newcomers to such systems find themselves in meaningful wholes, with established relations, practices, tools, division of labor, and rules (Roth & Y.-J. Lee, 2006). This stability might lead educators, in some circumstances, to reexamine the practice of streaming students by age and instead adopt multiage groupings typical, for example, of one-room schools. Again, the French experience is illustrative, for it was found there that there was an organizational memory, preserved in the activity structure with characteristic artifacts and practices. Because each new school year began with only a few students graduating, newcomers settled in and learned more quickly by becoming members of preexisting activity structures, which constitute a social world that outlasted any one individual (Roth, 2002). As in plucking a few fibers from a thread and replacing them with a few new ones, the changes in the overall structure through the contribution an individual makes are small and accumulate over longer periods of time; at the same time, the individual threads find a structure in place that constitutes a constraint on their place in the collective.

Consistent with the aforementioned control principles, students in these innovative institutions choose what they do, when they do it, whom they do it with, and so forth; at least at one elementary school, they even choose when to come to school (Collot, 2002), and in the high schools, they decide whether to come to the school at all on any one day. This arrangement eliminates the frequent complaint by teachers that they have to spend much time implementing the kinds of rules and behaviors that they deem optimal for learning. The outcomes on French national

exams in fact show that elementary students from such schools, though never subjected to direct instruction, perform slightly above the national average.

To briefly summarize why activity theory is highly suitable for and in praxis, we revisit Katherine, the fifth grade teacher, who has now enrolled in graduate courses in education. Exposed to CHAT as part of her course work, she discusses that very teaching episode involving the electrical circuits with her instructor, Ben:

Katherine: Well, thinking about that, it now feels like one of those theory-praxis gaps that you were sharing with us yesterday, you know?

Ben: It could be, but why do you think it was so?

Katherine: I think I now have a framework for understanding the contradictions that have arisen between my professional instincts, including those about theory—that model lesson plan—and my praxis (hands-on lessons), human development (the needs of *these* children at *this* time), and the difference between decontextualized knowledge (of words) versus the embodied and situated knowledge (direct teaching versus exploration). It also allows me to understand the difference between teaching (praxis), when I am oriented to the children subject to the constraints of the unfolding lesson versus my own descriptions of how I act in this or that real or hypothetical situation.

Ben: So how do you think this might this change what you are doing as a teacher?

Katherine: I really learned a lot from the environmental lesson exemplar and the way it is theorized that to learn, children have to be part of a larger context, being part of real activities that exist beyond the school rather than simply doing tasks, even the hands-on I used to employ. I think this orientation to real activity comes with an overall motive that students can realize in different ways and, in so doing, expand their own possibilities for living in an inherently complex world.

Coda

In this review, we showcase what has been called one of the best kept secrets of academia: CHAT. Thoroughly immersed in dialectics, this framework can potentially overcome a range of troublesome dualisms in education: individual versus collective, body versus mind, subject versus object, and theory versus praxis. By making activity the minimal unit of analysis, activity theorists take a holistic approach without reducing any pole of a dualism to its corresponding opposite. If in fact the polar categories are adopted into a new framing of problematic issues, then they are viewed as expressions of the same unit, neither one of which can be reduced to the other. This integration occurs at a higher level: the activity as a whole. This avenue therefore promises to lead to an integration of research that heretofore has often been kept separate, such as the sociological and psychological prerequisites of educational achievement. A researcher using CHAT therefore does not separate the poverty or culture of urban students' home lives from conditions of schooling, consideration of the curriculum, problems of learning, or learning to teach under difficult settings. Most important, CHAT cannot be viewed as a master theory or quick fix, for true to its origins, it is subject to inner contradictions, which compel researchers to update, transform, and renew constantly it so that it becomes a reflection of its object.

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Authors

WOLFF-MICHAEL ROTH is Lansdowne Professor of Applied Cognitive Science at the University of Victoria, MacLaurin Building A548, Victoria, BC V8W 3N4, Canada; e-mail *mroth@uvic.ca*. His interdisciplinary research interests concern knowing and learning in science and mathematics across the life span. He publishes in numerous disciplines and is editor or coeditor of three journals: *Mind, Culture, and Activity*; *Cultural Studies of Science Education* (with K. Tobin), and *FQS: Forum Qualitative Social Research* (with K. Mruck, F. Breuer, and J. Reichertz). Among his recent publications are *Doing Teacher-Research: A Handbook for Perplexed Practitioners* (SensePublishers, 2007) and *Talking Science: Language and Learning in Science Classrooms* (Rowman & Littlefield, 2005).

YEW-JIN LEE is assistant professor in the Natural Science and Science Education Section of the National Institute of Education, Singapore. He continues to bring to science and biology education concepts from qualitative research (e.g., discourse and conversation analysis, ethnomethodology, ethnography), sociology, philosophy, and organizational learning. In 2006, he was awarded, together with Wolff-Michael Roth, the Outstanding Paper Award at the Emerald Literati Network Awards for Excellence 2006 for *The (Unlikely) Trajectory of Learning in a Salmon Hatchery*. His publications include *Participation, Learning, and Identity: Dialectical Perspectives* (with W.-M. Roth, S. W. Hwang, and M. I. M. Goulart; Lehmanns Media, 2005).

APPENDIX B
IRB APPROVAL LETTER

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Rolando J. Marquez**

Date: **February 11, 2010**

Dear Researcher:

On 2/11/2010, the IRB approved the following activity as human participant research that is exempt from regulation:

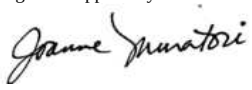
Type of Review:	Exempt Determination
Project Title:	A CULTURAL-HISTORICAL ACTIVITY THEORY ANALYSIS OF THE FACTORS AFFECTING ADOPTION OF TECHNOLOGY WITHIN A PROGRAM BY FACULTY MEMBERS IN HIGHER EDUCATION
Investigator:	Rolando J Marquez
IRB Number:	SBE-10-06698
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 02/11/2010 02:11:09 PM EST



IRB Coordinator

APPENDIX C
SUMMARY OF RESEARCH

EXPLANATION OF RESEARCH

Title of Project: A Cultural Historical Activity Theory Analysis of Factors Affecting Adoption Of Technology Within A Program By Faculty Members In Higher Education

Principal Investigator: *Rolando Marquez*
Other Investigators:

Faculty Supervisor: *Dr. Glenda Gunter*

You are being invited to take part in a research study. Whether you take part is up to you.

The purpose of this qualitative inquiry is to understand the choices that faculty members make in educational technologies and media. Traditional technology models have been somewhat ineffective in explaining the choices of educational media that faculty members make in higher education because they can not account for all the external factors present within an environment (Legris, Ingham and Collerette, 2003).

This inquiry will use Engeström's (1987) Cultural-Historical Activity Theory (CHAT). This framework takes a broader view of the contextual factors surrounding human activity such as instruction. The researcher anticipates that the broader perspective afforded by CHAT will provide additional insight as to compared to more narrowly focused traditional models.

The study design is based on a single site case study using interviews, observations, and document reviews. The research study will have a duration period of four weeks during the Spring 2010 term.

The volunteers to participate in the study will be asked to do the following:

1- Participate in class in the usual way and in the regular classroom with the researcher in the room. The researcher will observe participants while they take part in classroom activities and take notes on what he sees. The classroom observations will occur each class session throughout a four week period.

2- The researcher will ask volunteers to participate in interviews outside of class time. The interviews will take place in a place that is more convenient for the participant and will last approximately 15 minutes each. The interview questions may include: (1) answering questions on how they use educational technologies and media; (2) and their attitudes about the use of educational technologies and media. With the participant's permission, the researcher will use a digital recorder to record dialogue from the interviews. The participants will always be notified when the interview is being recorded and the recorder will be placed where the participant can see it.

The data collected from both interviews and class observations will be digitally saved on an encrypted computer drive, password protected, and will be destroyed within a period of 3 years after the study.

In order to lessen the probability of risks, the researcher will use pseudonyms to lessen the likelihood of a breach of confidentiality. In addition the recruitment methods use are designed to prevent anonymity. Finally, the interviews will be conducted at the faculty member's choice of location.

Data will be collected from interviews and observations will be transcribed. Document reviews will be conducted and will be obtained from discussion board posts, course handouts, and PowerPoint presentations. There is no need to collect student data or school records. Audio recordings will take place for facilitating accurate transcriptions as well as data integrity.

You must be 18 years of age or older to take part in this research study.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints *please contact Rolando Marquez, Graduate Student, Instructional Technology Program, College of Education, (407) 409-8676 or Dr. Glenda Gunter, Faculty Supervisor, Department of Educational Research, Technology, and Leadership at (407) 823-3502 or by email at ggunter@mail.ucf.edu*

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901.

APPENDIX D
OBSERVATION/FIELD NOTE SUMMARY FORM

Observation / Fieldnote Summary Sheet

(adapted from Miles and Huberman, 1994)

Contact Type: Visit

Site: _____

Contact date: _____

Written by: _____

Date Coded: _____

1- Pick out the most salient points in the contact. Number in order on this sheet and note page number on which point appears. Number point in text of write-up. Attach theme or aspect in each point in CAPITALS. Invent themes where no existing one apply and asterisk* those. Comments may be included in double parentheses.

PAGE	SALIENT POINTS	THEMES

APPENDIX E
INTERVIEW PROTOCOLS

First Interview Protocol

Hi. My name is Rolando Marquez and I'm a doctoral candidate at the University of Central Florida.

Purpose

First, I want to thank you for agreeing to participate in this research study on the selection and adoption of educational media by faculty members in Higher Education. I would like to talk to you about your own experience to help me better understand what this process is like for you and other faculty members when thinking about the choices you make on educational media for teaching and learning.

I want to remind you that participation is voluntary and that you do not need to answer any questions you do not want to answer. Before we get started, I would like to make sure you have signed an informed consent form.

Procedure

I will be taking notes and recording the discussion so that I do not miss anything you have to say and to remind me about questions for follow-up. I will transcribe the recording and analyze the transcripts. Your responses will be kept confidential. In fact,

we are going to use the pseudonyms you have chosen for our conversation. I want this to be a dialogue, so feel free to respond to me if you would like to add any information you may find useful. This discussion will last less than 20 minutes.

If I need to, I might occasionally move the discussion along to talk about other things.

Before we begin, do you have any questions? OK, thank you. Let's get started.

Interview question	Probe	Purpose	Research question
Do you use educational media in your teaching and learning activities?	What tools do you use? What will you do with this tool?	To elicit information about purpose and choice of technology	Perception of value and utility
How do you select the technology you use for teaching and learning?	Does your department provide guidelines and suggestions for you to use? Do you have an established set of guidelines when selecting media? How will you use the tool? Do you expect others to use it?	To identify the process of educational media selection and interaction of activity system	Tool related research question
What factors do you take into consideration when selecting educational media as you design course content and objectives?	What did you find helpful in the selection process? Are there some tools you like more than others? What makes a tool useful for you? What is the decisive factor when choosing between two tools? Which tools do you like and why?	To solicit information on the selection and implementation process of the tools	Tool related research question
Imagine that you are going to speak to other colleagues about your experience in choosing educational media. What would you like them to know?	What factors do I take into account when selecting media? Which media is the proper one to pick depending on the learning outcome? What makes one media more useful other another?		
We have covered a lot today- is there anything else you would like me to know?		To identify belief systems and set a stage for the second protocol	

Second Protocol for Interview

First, I want to thank you for allowing me to sit with you during your work session today. As I have told you before, I am interested in learning more about the choices that you make regarding educational media for teaching and learning. Today, I am especially interested in finding out how you think about your work and the tools you are using.

Procedure

Throughout today's work session, I would like for you to share your thoughts with me. With your permission, I videotaped you as you work. I may play parts of the tapes for you and ask you if you can recall what you were thinking or to provide further information about some of your actions.

Before we begin, do you have any questions?

OK, thank you. Let's get started.

Prompts

APPENDIX F
STUDY CODING

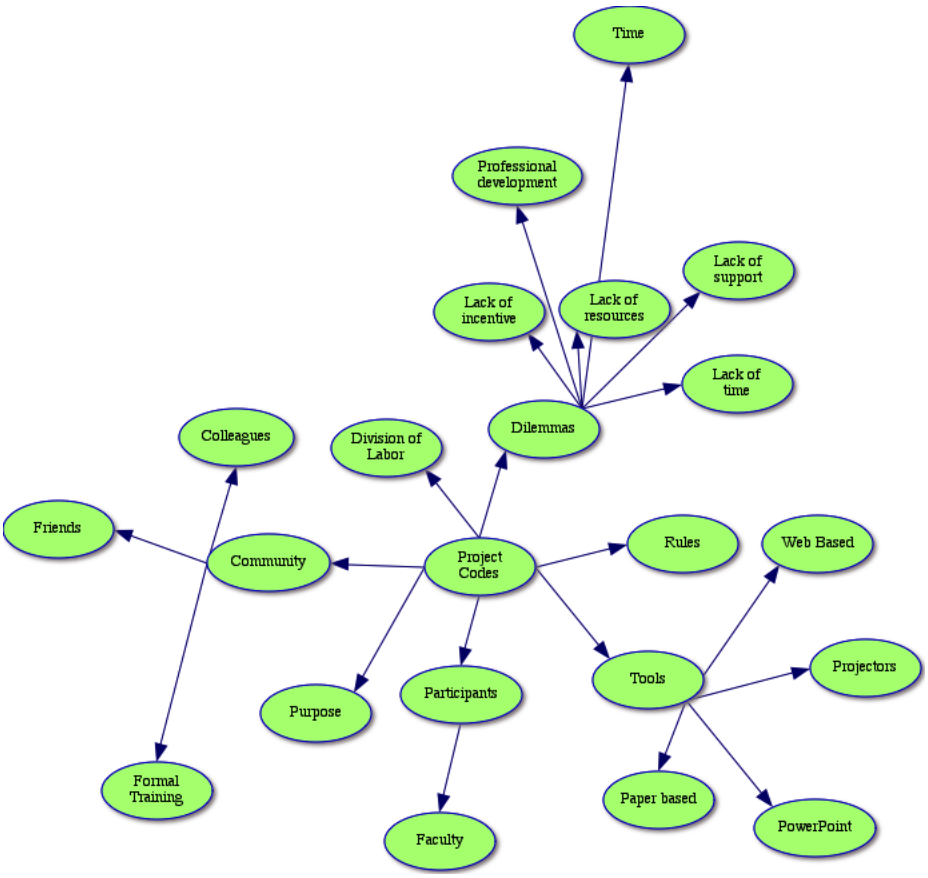
STUDY CODING

Coding is essential to a qualitative inquiry. The process of coding allows a researcher to come up with new ideas and rearrange materials by topic. The results of coding can help a researcher develop ideas "and take inquiry further" (Richards; 2005). The idea behind coding is to learn from the data and revisit it in a cyclical fashion until the patterns and explanations present are understood by the researcher. Researchers use a variety of methods to organize their data such as color coding, using post-it notes, writing notes in the margins of field notes and transcripts; and sorting documents into piles and file folders.

Computer-aided data analysis offers advantages when compared to the record keeping of old days. The researcher can harvest the computer's capabilities for storage, organization, and retrieval. Digital files take small amounts of space to store and files can be organized and rearranged in a non-destructive fashion. After assigning codes are to the units of data, qualitative data analysis software facilitates the retrieval of the various units by their assigned code. Qualitative data analysis software also allows for complex searches and can also automate repetitive tasks such as assigning a participant code each time that participant's comments appear in a transcript.

Factors that influence the codes for this inquiry include the research questions as well as the Cultural Historical Activity Theory (CHAT) theoretical framework. To determine the initial codes for this project, the researcher reviewed the literature in the field of technology adoption in education, specifically higher education. Once that task was completed, the CHAT model and research questions were reviewed in order to align

the codes with the nodes in the CHAT framework (Figure 1). This process of developing an initial list of codes was suggested by Miles and Huberman (1994).



Initial Project Codes

Once generated, this list will be imported into Atlas.ti to use while taking part of the study. As the researcher worked with the codes, he began to define them more clearly and noted the definitions in the comment field of the code. There was a very distinct possibility that the number of codes would change as the need arose to broaden or narrow the codes.

APPENDIX G
DOCUMENT ANALYSIS SUMMARY FORM

Document Analysis Summary Form

(adapted from Miles and Huberman, 1994)

DOCUMENT FORM

Site: _____

Document: _____

Date received: _____

Name or description of document:

Event to which the document is associated:

Significance or importance of document:

Brief summary of contents:

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