AN ACTIVITY THEORY EXPLORATORY OF THE DIFFERENTIAL IMPACT
ON STUDENTS’ AND PROFESSORS’ EXPERIENCES IN HOW
LAPTOPS ARE USED FOR INSTRUCTION

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ABSTRACT

This exploratory study examined the differential impact of a laptop initiative in two general education classrooms during the winter term session of the 2009-2010 academic year at Midwest institution of higher learning. Beyond observing these two classrooms, a total of 12 student volunteers and two instructors were selected from the laptop using and non-laptop using classrooms for focus group interviews. In total, the researcher conducted 22 classroom observations per each class. Cultural Historical Activity Theory (CHAT) was used as a tool to analyze different tensions that occurred within or between different components of the laptop activity for both classrooms. The researcher also collected evidence to explain the justification for using laptops in the classroom, the benefits, disadvantages, and the reason behind expressed reluctance to applying laptops in instruction.

Findings from qualitative data revealed that students from the laptop using class appeared more enthusiastic about having a laptop for classroom activities than students in the non-laptop using classroom. The factors which contributed to such success were the instructor’s motivation, the integration of the interactive software (DyKnow), tablets, and a well-organized pedagogy. The finding for this investigation have implications for educators, instructors, researchers, policymakers, and are intended to assist institutions of higher education especially those passionate to integrate laptop in learning.
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CHAPTER 1

Introduction

Overview

As electronic innovation continues to advance, learning institutions are increasingly interested in applying technology in the classroom. According to Trotter (2007), several academic institutions, private organizations, and parents argue that integrating the computer into the classroom is one way to keep this nation ahead technologically and economically. As a result, more computer-based learning technologies are being integrated into the everyday classroom than ever before (Cuban, 2001; Ertmer, 2005; Lynn-Nelson, 2007). Many higher education institutions have responded to these changes by requesting and even requiring every undergraduate student to carry a laptop or other type of learning media into the classroom (Cuban, 2001; Warschauer, 2006).

Different institutions have initiated laptop programs for diverse goals and objectives. The reasons and motives behind implementing laptop programs also vary from institution to institution. In previous studies (Gravelle, 2003; Penuel, 2006; Walker, Rockman, & Chessler, 2006), evaluators and researchers have expressed mixed views when it comes to identifying the rationale and goals for laptop initiatives in different institutions. Some share the same views regarding goals and objectives, but in some cases they have different observations.
Many researchers reveal that most institutions intend to integrate laptop instruction in teaching and learning for different purposes which include the increase of the use of technology, decrease of the digital divide, increase of student-centered instruction, and to increase student achievement in specific courses (Penuel, 2006; Walker et al., 2006). Likewise, Warschauer (2006) indicated that most schools had adopted laptop instruction because the laptops increased positive attitudes and motivation towards learning and teaching. Other factors associated with laptop adoption include increased student attendance, better developed study skills, and improvement of the communication between schools and home or between teachers and students (Windschitl & Sahl, 2002; Zucker & McGhee, 2005). Zucker (2004) found that numerous schools adopted a laptop initiative with the motive of reducing the digital divide and to support curriculum transformation. According to Roschelle, Penuel, and Abrahamson (2004), a networked classroom where students carry mobile devices, has been shown to increase student learning, especially in math and science.

Despite research that shows progress in laptop-enhanced methods, there is still some reluctance and controversy among students and faculty members on the effect and transformation produced by the use of laptops in the classroom. Rovai and Childress (2003); Naidu, Cunnington and Jasen (2002); and Olsen (2001) noted that there are a number of students and teachers who are still skeptical as to whether using laptops in the classroom is more effective than using traditional teaching. They hold that computer-based instruction requires far more effort, resources, and preparation than employing traditional materials to teach students. In his research, Ruth (2006) hints that several institutions of higher learning offer some useful training to assist students and professors in overcoming some difficulties associated with technology-mediated courses, but these sessions are time consuming.
On the other hand, there are others who advocate and foster new teaching strategies that include a laptop classroom initiative. One teacher, Roberts (2005), who advocates such an initiative, noted that few efforts have been made to find effective types of technologies and methods that assist the 21st century generation of students to learn effectively. Dede (2006) argues that some students have difficulties in adapting to the traditional learning styles, where the learning environment conflicts with their social behavior. In addition to the teacher’s views, a student who is a digital native expressed his concern.

Technology bans are incredibly frustrating for me, as a millennial, but I don’t know what else to suggest. Surely there’s a clever solution that doesn’t result in restricting what tools students can use to learn? Whoever figures it out will be famous. (Cole, 2008, p. 1)

In addition to the challenges related to resistance to laptop use in school, evidence from previous studies indicates that some schools are facing challenges to sustain laptop instruction for financial reasons. It was recently observed that schools are abandoning their laptop initiative due to the increase in cost of laptops and the cost of professional development (Cuban, 2001; Georgia system ends laptop program with debt and claims of success, 2001; Hu, 2007; Olsen, 2002, 2001; Warschauer, 2006).

All of these different considerations suggest that as the laptop initiative takes effect, it may cause resistance and change in classroom activities, curriculum, and sociocultural settings. Consequently, enhancing laptop usage in the classroom continues to be a challenging topic and stumbling block for learning institutions that advocate the laptop initiative. Thus, a study is needed to investigate the differential impact of the laptop as an instrument for supporting the teaching and learning processes of students and professors in their classrooms.
Statement of the Problem

While some previous studies have investigated computer adoption behavior among different classroom users, most of these studies lack a grounded theoretical framework that explains the complex questions that still linger in the minds of students, professors, and university administrators, day to day (Penuel, 2005). Oliver and Harvey (2002) investigated the impact of using a theoretical framework to evaluate teaching and learning technologies in higher education. They concluded their thoughts thusly.

Unless they explicitly start to build models – and theories – of the phenomena they are investigating, there will be no credible warrant for the conclusions they draw. Given our growing appreciation of the complexity of the topics under investigation, calls to common sense understanding no longer provide convincing justifications for claims.

(Oliver & Harvey, 2001, p. 24)

To rationalize this claim, the researcher documented the results of a literature search for this study. The literature search reveals that 25 out of 45 scholarly articles related to this investigation lack a supporting theory. The example of the literature matrix used in this study can be found in Appendix A.

Additionally, the outcome of previous investigations has shown no significant difference among the users (Hu, 2007; Hung & Hsu, 2007). Moreover, there is scarce scholarly literature that explains the impact of laptop programs on teaching and learning (Russell, Bebell, & Higgins, 2004; Warschauer, 2006) in higher education environment settings, in particular. For example, the results obtained in the literature search shows over 60 articles, where one dozen of those were related to the laptop program in higher education and the remaining number examined the laptop program in the K-12 schools (See the example in Appendix A).
This study demonstrates the capacity of a chosen theoretical framework, Cultural Historical Activity Theory (CHAT), to explain students’ and professors’ technology usage within the context of the classroom laptop initiative in the limited setting of two classrooms of a Midwestern institution of higher learning. Using CHAT, the researcher collected evidence to understand the differential impact of laptop usage behavior among students and professors, the rationale for using laptops in the classroom, and the reasoning behind reluctant behavior for using laptops in the classroom. In another words, CHAT was used as a tool to examine day-to-day experiences of students and professors.

**Theoretical Framework**

Activity Theory originated from two Russian researchers, Vygotsky and Leont’ev, and later the model was expanded to become CHAT. Both researchers originally used Cultural Historical Activity Theory to analyze or to monitor individual activities (Kuuti, 1996). Later Engeström (1987) expanded on the earlier work of Activity Theory and developed CHAT to explain how a group or collection of factors interacts to transform human activity, ultimately presenting it in a series of triangles as shown in Figure 1. Engeström revealed that whenever there is human intervention contradictions emerge and evolve within six different dimensions of an activity.

In Engeström’s model, the subject represents humans or a group of individuals who are always involved in an object-focused activity (work or goal-oriented action) that is driven by a common purpose to reach an outcome. The subject’s interaction is mediated by tools (instruments or artifacts) to achieve a goal (object) of an activity system. In addition, the interaction of the subject (human) and community within an activity are regulated by the rules
and norms while the community interacts with the subject that results in a division of labor (Barab, Evans, & Baek, 2001; Engeström, 1987; Nardi, 1996).

To illustrate the model depicted in Figure 1, consider the fictitious example from a professor of mathematics education: Dr. Al and his freshman student named Jake. Dr. Al is thrilled because he found useful software to simulate and draw graphs for his algebra class. For instance, he mentioned that when he wants to demonstrate the change in slope, students plug coordinate numbers into the special computer-graphic interface and the computer shows the change in slopes in slow-motion rate. “I am relieved; the laptop initiative has since freed me from the use of traditional methods of teaching,” Dr. Al said. “With this software, students can help each other through interactive software I created,” he exclaimed. But, Dr. Al found some drawbacks in the university’s laptop initiative. There were logistical challenges because most university classrooms lack sufficient electrical sockets to power all laptops. It is also difficult to handle technical problems within the fifty-minute period. In addition, students are always “distracted” by Internet media, such as Facebook.com and Myspace.com. Moreover, “professors and students are not getting full support at the information technology (IT) help desk,” he added. “It is unrealistic to get things done with this laptop business,” he concluded.
Jake is a freshman student and enrolled in Dr. Al’s algebra class. He is always late to complete his assignments because his laptop has worms and a virus which make it very slow. Jake thinks Dr. Al’s math software is a very complicated program for a novice student. While Jake starts each day with a fully-charged laptop battery, by the time he gets to Dr. Al’s class he has a low charge on his battery. However, Jake finds some benefit to bringing his laptop in the classroom, including Facebook and MySpace. Jake usually uses Facebook or MySpace to coordinate study sessions with his classmates. After the class session, Jake and his friends plan to focus on learning how to use Dr. Al’s math software. Jake can also access Facebook and email even though these Internet tools are not to be accessed during class time. Dr. Al’s rules against student use of email and Internet media frustrate Jake’s efforts to coordinate study sessions with his friends. He wishes Dr. Al recognized the legitimate uses of the Internet media. Like Dr. Al, Jake also believes that the math software provided by Dr. Al will help him learn once he masters the software.
It is evident that this vignette should be interpreted in terms of the CHAT model. The subject refers to Dr. Al and Jake because they are the individuals who use laptops (tools), software (tool), electrical outlets (tools) to enhance teaching (object), and complete curriculum requirements (outcomes). The community consists of a group of students involved in learning. In addition, the subjects (Dr. Al and Jake) relate to the community through rules or norms (no access of Facebook or MySpace in the classroom) and the community achieves the object through division of labor (the help from the help desk, student collaboration, and the teacher’s help).

The most important components which are not shown in this model are tensions or contradictions that appear within actions or components of an activity system. Contradictions are very important because they lead to different transformations, development, and the innovation of the system, but can be disturbing elements to the activity system (Nardi, 1996; Roth & Lee, 2007). According to Engeström (1987), any activity system has four levels of contradictions and usually they occur in a work situation as follows.

The primary tension occurs within each segment of the activity under investigation. In this vignette, initially Jake had a hard time understanding how Dr. Al’s software works. This may have conflicted with Jake’s learning process and how he uses the laptop, but in the long run, Jake got help from members of his class and finally realized how the software can be helpful when it is understood.

Secondary tension takes place between any two nodes in the model. In this example, there was secondary tension between “Rule” and “Tool.” Jake and his classmates were not allowed (rule or norm) to access Facebook (tool) and MySpace (tool) during Dr. Al’s class, but
Jake could use Facebook to coordinate after-class study sessions with his classmates where he could learn how to use Dr. Al’s math software.

Tertiary tension arises between the old way of doing an activity and the new way of engaging in an activity system. In this vignette, electrical outlets in old buildings are inadequate for today’s classroom activities; it would be adequate to have electrical sockets installed in all student desks.

Quaternary tension exists between the central activity and neighboring activities. In this scenario, quaternary tension arises between Jake’s nearby activities of algebra class and of student life. He ordinarily uses Facebook and MySpace to communicate with friends and plan events for both social and academic activities. The "tension" arises when Jake cannot use those tools while he is in class, even though he intends to use the social media to arrange for study sessions. Figure 2 illustrates the quaternary tension.

![Figure 2](image)

Officially - No Facebook allowed. Student practice is to use Facebook for legitimate learning purpose.

*Figure 2.* Tension between the central activity and neighboring activities.
Rationale and Importance of the Study

This study is exploratory research that describes the impact of the laptop initiative in the laptop using classroom and the non-laptop using classroom. The methodology of this research was to use a qualitative approach based on observations and face-to-face interviews to learn about the differential impact of the laptop as an instrument for supporting learning processes of students and professors in the classroom. As suggested by Patton (2002), qualitative inquiry produces powerful results especially when investigator’s interviews and observations are conducted from credible sources such as researchers, instructors, and students. Quible (1998) noted that observation and interviews of a particular focus group allows a rich dialogue between participants and stimulates exchange of critical information and feedback among the group members. Gaining different views, feelings, assumptions, and opinions from a group involved in a common activity gives the researcher a closer understanding and a foundation for suitable analysis (Marshall & Rossman, 1999; Patton, 1990).

The purpose of this qualitative inquiry, therefore, was to understand the differential impact of a laptop initiative in the laptop using classroom and the non-laptop using classroom. Various strategies influencing the classroom were reviewed and analyzed through the students’ and professors’ experience. The inquiry used CHAT to support the researcher’s efforts to examine and better understand the impact of the laptop initiative in the laptop using classroom and the non-laptop using classroom.

Though most theories focus on a more predictive nature, CHAT’s major strength is its high capacity for analyzing human activity. Researchers have demonstrated that CHAT is a powerful tool to analyze the student- and teacher-learning activity, especially in computer-based and collaborative-learning settings (Jonassen, 1996; Nardi, 1996; Roth & Lee, 2007). Therefore,
CHAT was the ideal theoretical framework to investigate the difference in students’ and teachers’ experience of laptop use in the classroom at a Midwest institution of higher learning (MIHL).

The study interviewed 12 students and conducted classroom observations with 44 undergraduate students and two instructors, from two sections of Technical and Professional Communication classes at MIHL. Each section had 22 students. The participants of this study were undergraduate students majoring in various areas of engineering technology. The outcome of this research is useful in informing decision makers as they plan for the initiation, continuation, and progress of the laptop initiative. More importantly, the results of this research provide significant contribution to future research in the area of classroom-technology integration. Moreover, it identifies both motivators and demotivators to participate in the laptop initiative.

**Research Questions and Objective of the Study**

The following research questions were formulated to guide the focus of interviews and in-class observation:

(a) What are the student’s experiences in laptop using and non-laptop using classrooms?

(b) What are the teacher’s experiences in laptop using and non-laptop using classrooms?

(c) What are the benefits, if any, students and professors have had in using the laptop?

What are the implications or impacts of using laptops in classrooms?

The objectives of this study are:

1. To examine how students and professors respond to the laptop initiative in terms of learning processes.
2. To explore the differential impact of laptops on teachers’ use of teaching strategies and students’ use of learning strategies.

3. To provide suggestions for improving the laptop initiative to prepare a learning environment suitable for all students.

4. To provide a foundation for future investigation in this academic arena.

Limitations

There were some parameters in this proposed study. First, the study was limited to the sample population of the students and professors from a laptop using and a non-laptop using classroom of Technical and Professional Communication at a Midwest institution of higher learning (MIHL), rather than including more participants from other departments or other academic institutions of higher learning. In addition, the participants of this study were from two general education classrooms and the results of the study could be different if participants from other departments or universities were added. This implies that the outcome of this study should not be generalized to all professors and students of higher education.

However, the combination of the strong theoretical framework and the rich literature review from previous researchers contextualized the study and strengthened the findings to overcome the weakness associated with the boundaries heretofore mentioned. Moreover, this inquiry was not focused on generalization, but it was focused on detailed information that provides an in-depth perception of the laptop initiative as viewed by the selected group of students and professors who experience this real-life situation.

Above all, such limitation is common, acceptable, and consistent within qualitative inquiry because it helps to narrow the scope of study (Creswell, 2003). Finally, study limitations do not always show a weakness in qualitative research. The limitations could be a sign of the
existence of the honesty and integrity of the investigation and may be seen as a strength for
future explanations in the same area of study (Creswell, 2007). Thus, the boundaries mentioned
in this study were deemed justifiable, and consistent with the inquiry.

**Delimitation**

This was a 12-week long study and was limited to a specified category of participants.
The conclusions of this study are not extended beyond the sampled population of the two
heterogeneous classes. Thus, the results and outcomes of this study are not generalized.

**Assumptions**

This investigation depended heavily on the honesty of its participants. Some participants
could have chosen not to reveal the truth about their feelings, as they might have seen it as
“unsafe” to speak the truth about this topic. To bring credibility and accuracy of the results to
this study, the researcher conducted classroom observations to identify persistent patterns of
activities that participants may have not been able to see or reveal during group interviews. In
addition, he used the triangulation method to overcome any discrepancies and contradictory
information that might have brought bias to the findings (Creswell, 2008). In addition, the
researcher used two critical friends to offer advise, evaluation, and different opinion about the
data analysis. The use of triangulation and critical friend procedures are explained in detail in the
research methods of this study.

**Definition of Terms**

Like other studies, it is very important to explain some terminology that may be
unfamiliar to the readers. The following terms are used in this research:

1. *Overt participant observation*: The researcher is open and familiar with the group
   identified in the study.
2. *DyKnow Vision:* Interactive software used for teaching and learning. It is a tool that promotes classroom collaboration.

3. *Snowballing techniques:* A technique used in literature research which starts with known articles and then becomes a larger body of work that includes other authors who have written on the same subject.

4. *Review matrix:* A chart created by the researcher to organize the summarized data in a systematic way for further reference.

5. *Focus group interview:* An interview where the participants are selected in a small group to participate in a study (Creswell, 2007).

**Overview of Method Design and Procedures**

The interview method was designed to elicit information from both instructors and students on experiences of using laptops in the classroom at MIHL. An equal number of participants (volunteers) were selected from one laptop using classroom and one non-laptop using classroom to participate in interviews. The focus group participants were selected purposely from the two classrooms to maximize diversity in age and gender. All interviews consisted of open-ended questions, which allowed a wide scope of discussion between the interviewer and respondents (Patton, 2002).

The researcher who carried both roles of observer and interviewer gathered information from participants through informal or arranged meetings. All interviews were conducted in convenient location for the participants, audio-recorded, later transferred to a computer, and analyzed.

The aim of the observations was to support the accuracy of the data findings collected through interviews (Creswell, 2008). The direct or *overt observation* process was used to gain a
general perception of students’ interaction with their instructor and classroom activities/laptop usage. The observation included the field notes and audio recording of professors’ and students’ activities and interactions in respect to the focus of the subject of study. Observational data was transcribed in a notebook and transferred to digital media for analysis.

**Summary**

The study was designed to learn the progress of the laptop initiative at MIHL. Precisely, this qualitative inquiry used CHAT to inform the researcher’s efforts to examine and better understand the s of the laptop initiative in the laptop using classroom and the non-laptop using classroom. The results from the data provide insight into the impact of the laptop as well as insight into students’ and professors’ experiences in the laptop using and non-laptop using classrooms. Besides that, the study provides a solid foundation and discussion for future study, and can inform policymakers in the development of the laptop computing program.
CHAPTER 2

Literature Review

Overview

The purpose of this section is to present a review of the literature related to the laptop initiative in a laptop using classroom and a non-laptop using classroom. To enhance the quality of this investigation, the researcher collected empirical evidence from rigorous evidence-based studies that examine issues related to the laptop initiative in institutions of higher education and K-12 schools. The chapter focuses on the following key areas (a) the process for searching and choosing articles, (b) the laptop initiative in an educational arena, (c) successful laptop implementation, (d) the major impacts of the laptops on students and educators, (e) aims and objectives of the laptop initiative, (f) factors influencing successful laptop implementation in the classroom and the potential barriers to success, and finally, and (g) Cultural Historical Activity Theory as a tool to analyze laptop activity in higher education and K-12 setting.

Process for Searching and Choosing Articles Related to the Study

The protocol for gathering the literature related to this study started by locating resources from multiple databases, such as ProQuest, ERIC, Academic Search Premier, Educause Learning Initiative (ELI), Dissertation Abstract International, and search engines. Specifically, the search primarily included the most recent reference books, dissertation abstracts, peer-reviewed journals, conference reports and proceedings, and other web articles pertinent to the topic. For
the purpose of quality control of the relevant literature, the researcher used controlled vocabularies to retrieve articles of interest and restrict the irrelevant ones. The prominent key words include “impact of laptop in higher education,” “laptops and teaching practices and professional development,” “laptop-assisted instruction,” and “ubiquitous computing.” More information regarding the searching strategy and gathering library materials of this investigation are available in the *Review Matrix* (Appendix A).

**Search Criteria for Inclusion and Exclusion**

To ensure that all relevant and appropriate titles were captured, the researcher followed the search criteria as described below. In this process, the research included the particular literature that focused on the “impact of laptop computers” or “experience with ubiquitous computing.” Then, the researcher applied different criteria for articles that fell in categories of “impact on laptop computers” and those called “experience with ubiquitous computing.”

The articles selected as “experience with ubiquitous computing” exhibited the following criteria, (a) theoretical framework, (b) use a quasi-experimental or experimental design, (c) sampling method, and (d) peer reviewed. On the other hand, the group of articles named “impact on laptop computers” included, for example, a conventional method of data analysis and data-collection methods. It is also essential to point out that sometimes key words were interchanged during the literature search. The interchanged keywords included:

- Laptop computers, portable computers, and mobile learning.
- Laptop computing, ubiquitous computing, and laptop instructions.

The systematic search obtained over 100 articles, where one dozen of those articles were related to the laptop program in higher education and the remaining number examined the laptop program in the K-12 schools. For the purpose of this study, the investigator gathered the results
from both levels of education. The scarcity of literature on the laptop initiative in higher education suggests the urgency of conducting the study that demonstrates an overview of the impact of laptop adoption in a college or university setting (Penuel, 2005; Zucker, 2004).

In addition, the search results from the initial 60 articles reviewed revealed that most researchers used a quasi-experimental method and 25 of 45 articles lacked a theoretical framework (see the example in Appendix A). After reading all articles related to the impact and experience of using laptops in academic arena, a subsequent decision was made to prioritize the relevant articles. In order to facilitate and manage a list of relevant articles, they were summarized, synthesized, and the bibliography of literature review was ultimately managed by the EndNote X3 program. Garrard (2007) points out that a snowballing technique should be used to prepare a solid reference list relevant to the topic. Moreover, she advocated that the presence of the most current publications enhance the quality and rigor of the literature review. Therefore, the researcher used the same method to gather additional publications related to the study. The same procedure was used to search information pertinent to the Cultural Historical Activity Theory as a model for analyzing computer activity.

Due to the volume of the summarized materials, it was critical to set up an organizing tool to assist in backtracking through pertinent information related to the literature review. The literature suggests different ways of keeping track and organizing the summarized articles. Typical among the suggestions is the use of a flowchart and literature map as visual representations that can assist the researcher to connect his or her investigation to related topics (Creswell, 2003). Garrard (2007) proposed using a method known as review matrix. The review matrix is a useful chart that allows the researcher to organize the summarized data in a systematic way for further reference. In this situation, the researcher used both a review matrix
and a literature map to relate this study to the existing literature. The identified results were summarized, synthesized and classified into different major themes or key areas as mentioned in the first paragraph of this chapter.

**The Laptop Initiative in the Educational Arena**

The use of the laptop and other related mobile technologies have enjoyed increasing popularity in many learning institutions (Finn & Inman, 2004). The first experimentation in integration of a laptop program was launched in different U.S. schools in the late 1980s with Apple Classrooms of Tomorrow (Donovan, Hartley, & Strudler, 2007). The project was devoted to transforming the curriculum into teaching based on technology. To accomplish this goal, the project distributed laptops to K-12 students and teachers.

The laptop initiative in schools became more popular in 1996 when Toshiba and the Microsoft Corporation started a laptop program called the “Anytime Anywhere Learning Program,” in 29 schools across the nation (Hadeed, 2000; Walker, Rockman, & Chessler, 2006). This program was launched to find out whether providing Internet connection and a laptop to every student would improve the method of learning. The program provided laptops with Microsoft software to all students and teachers. After a series of student evaluations and faculty interviews, it was found that laptop-enhanced instruction significantly improved student learning.

Today, laptop computers are no longer luxury tools, but universally available and popular instruments. By 2002, researchers estimated that the laptop initiative had been implemented in over 1000 colleges and universities (Windschitl & Sahl, 2002). Studies have revealed that laptop adoption and successful implementation requires effort and is an expensive undertaking (Cuban, 2001). Some programs are still in the initial stage, more have shown remarkable progress, others have dropped the project, and more still have a concern for how to keep the project going.
In this study, Donovan et al. (2007) argue that motivation for initiation of laptop programs vary from one organization to another.

**Aims and Objectives of the Laptop Initiative**

In examining studies of laptop computing, the relevant literature reveals different aims and objectives of the laptop initiative in educational institutions (Penuel, 2006). Investigations suggest that introducing a laptop program in educational institutions will increase technology access for many students and give them an opportunity to learn effectively (Oliver & Corn, 2008). For example, Finn and Inman (2004) and Penuel (2006) documented that mandating laptop or mobile devices helps in bridging the digital divide between students who have opportunities to use computers often and those who have limited accessibility. Furthermore, Warschauer’s (2007) investigation affirmed that laptop implementation on campuses transforms the method of teaching and learning and train students for employment in the digital age.

Tangentially, other research reports suggest that implementing a laptop program in some learning institutions has been triggered by concerns that their program will lag behind in bridging the digital divide (Finn & Inman, 2004; Gravelle, 2003; Penuel, 2006).

The most reported goals associated with use of laptops in classroom include the decrease of the digital divide and increase of the use of computer technology (Gravelle, 2003; Penuel, 2006; Walker et al., 2006). The second most cited goals are the improvement of communication between students and teachers, student achievement, and student study habits (Fairman, 2004). Warschauer (2006) also reported the increase of confidence and attitude among students and improvement of attendance as major goals. In the same perspective, Dawson, Cavanaugh, and Ritzhaupt (2008) found that a number of educators opted to shift to the student-centered method...
of teaching. Table 1 shows the summary of the most common goals for implementing laptops in different educational institutions.

Table 1

Most Common Goals for Implementing Laptops in Educational Institutions

<table>
<thead>
<tr>
<th>Author and Year of Publication</th>
<th>Goals</th>
<th>Educational Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oliver and Corn (2008)</td>
<td>Improvement of access to computer technology for all students</td>
<td></td>
</tr>
<tr>
<td>Weaver and Nilson (2005); Dawson et al. (2008)</td>
<td>Professional development and instructional practice for educators.</td>
<td>In over 50 K-12 schools in Florida District; Clemson University.</td>
</tr>
<tr>
<td>Warschauer (2007)</td>
<td>Prepare graduates who can compete in the job market.</td>
<td>10 California and Maine K-12 schools.</td>
</tr>
<tr>
<td>Percival and Percival (2008); Barak, Lipson, and Lerman (2006), Dawson et al. (2008)</td>
<td>Transformation of the curriculum toward student-centered learning and increasing student cognitive learning ability</td>
<td>In over 50 K-12 schools in Florida District.</td>
</tr>
<tr>
<td>Finn and Inman (2004)</td>
<td>To diminish the digital divide.</td>
<td>Grove City College.</td>
</tr>
<tr>
<td>Tan and Morris (2005)</td>
<td>Increase of the use of different computer technologies.</td>
<td>Oakland University.</td>
</tr>
</tbody>
</table>

Successful Laptop Implementations

A successful laptop program was reported at the University of Minnesota at Crookston (UMC). Lim (1999), the Director of Instructional Technology Center at University of Minnesota at Crookston, an author of Ubiquitous Mobile Computing: UMC’s Model and Success, conducted an online survey among the graduating classes of 1993 to 1999 at UMC. The study was intended to learn the impact of ubiquitous mobile devices among students and faculty members. Lim’s
findings revealed that the combination of administrative and technical support or help desk had a significant impact on student learning. In addition, he reported that the University of Minnesota at Crookston had been among the first institutions in the United States that successfully transformed the entire campus from the paper-based learning to a digital classroom. In addition, results showed that Crookston University launched the laptop program at 1993. By 1998, 80% of the student body responded that the laptop program was successful and very beneficial to them. By 1999, 93% of the graduating students responded that they were very comfortable with the use of laptop; and skills learned from it would be helpful in the future careers.

Other researchers have acknowledged a number of successes in using the laptop program in various colleges and universities. Feedback from a survey that assessed the effects of the laptop initiative among the alumni at Grove City College in Western Pennsylvania demonstrated progress and success of the program (Finn & Inman, 2004). Similar accomplishments were identified at Minnesota State University, Mankato. At this institution, around 50 faculty members in the College of Business successfully encouraged and trained the remaining departments to embrace the infusion of the laptop program (Hall & Elliott, 2003). The appeal and optimistic application of the teaching method called “Seven Principles of Good Practice” at Winona State University yielded success in its laptop program (McVay, Snyder, & Graetz, 2005). Likewise, levels of achievement in classes that integrated laptop instruction put the laptop instruction of the United States Military Academy at West Point at the forefront of institutions using laptops (Efaw, Hampton, Martinez, & Smith, 2004).

During the 2002, 2003, and 2004 academic years, Weaver and Nilson (2005) conducted three consecutive surveys to view the progress of the laptop program at Clemson University. In this particular program, the university had developed a mandatory laptop program for all colleges
and departments where upon entering freshmen bring their own laptops to campus. In addition, the university established solid mandatory training sessions for the faculty members. The results of Weaver and Nilson demonstrated that this program offered an exemplary model in terms of effective teaching technology, designing professional development for the teaching staff, promoting student collaboration, and the encouraging willingness to adapt to the new laptop technology.

Likewise, the Laptops for Learning Task Force witnessed a similar successful outcome in a Florida school system (Barrios, 2004). The task force reported that the Florida School System had achieved outstanding results for several years in terms of decreasing the digital divide, enhancing computer skills, and improving meeting of state standards, classroom teaching, and community involvement. Nevertheless, the same report observed some minor challenges in some school districts linked to cost effectiveness of the laptop and technical support and sustainability of the program.

Recent literature has identified accomplishments of the laptop program in public schools. Improvements in terms of information literacy among students and teachers is attributed to Maine and California K-12 schools (Warschauer, 2007) and New Hampshire middle schools where the program evaluations of one-to-one computing concluded with several positive improvements and successes (Bebell, 2005). Bebell noted that providing a laptop to every child added more benefits in building confidence and strong team collaboration. In addition, the laptop initiative contributed to increases in student interaction and engagement, to higher student attendance, and to transformation of the teaching and learning.

A similar accomplishment is reported at the Maine Learning Technology Initiative (MLTI) where a total of over 200 public schools provided laptops to all 7th and 8th graders and
professional training to their teachers (Muir, Knezek, & Christensen, 2004). In this study, the authors reported positive impacts on teachers’ motivation, professional development, instructional practices, and a more positive learning attitude among students.

Another large implementation is believed to be in Henrico County, Virginia, where around 2500 laptops were distributed to 6th to 12th grade students. In addition, the Walled Lake Consolidated Schools laptop program for 5th and 6th graders was found to be successful and effective (Lowther, Ross, & Morrison, 2003). Last, but not least, the most popular and largest program is found in multiple K-12 schools in 11 Florida districts where using laptop instructions is thought to be at an optimal level (Barrios, 2004; Dawson et al., 2008). New Hampshire middle schools and California K-12 schools provide mobile computers, loaded with application software to all incoming students and faculty to incorporate information technology into learning (Bebell, 2005; Warschauer, 2007). Intensive progress of one-to-one implementations also are found in several institutions that include, but are not limited to, North Carolina at Chapel Hill and Henrico County (Virginia) where students of different school levels are given laptops for educational purposes (Bebell, 2005; Russell, Bebell, & Higgins, 2004).

In the higher education setting, University of Minnesota at Crookston began its mandatory laptop program in 1993 and still ranks as the first and largest laptop program across the nation (Lim, 1999). Rose-Hulman Institute of Technology initiated its laptop program in the fall quarter of 1994, and every incoming freshman has been required to buy a laptop computer since. Currently, their laptops are used to teach different courses from mathematics, physics, engineering, chemistry, engineering, and graphic design. Today, students are able to connect their laptops into approximately 7,000 wired Ethernet ports located on the campus (Rose-Hulman Institute of Technology, 2009). Winona State University (WSU) began its mandatory
laptop program in 1997 and still ranks among the first and largest laptop program across the nation (McVay et al., 2005).

Indiana State University started a laptop program in the fall of 2007 that supports a number of undergraduate students. Even though the initiative is still in its early stages, the policymakers hope that every undergraduate student will own a notebook computer by August 2010 (Learning in a Digital World, 2005). A well-organized and advanced laptop computing program has been found in the Wake Forest University initiative which began with freshman students entering in the fall of 1996 (Brown & Petitto, 2003). Another program which is consistent and steady is at Clemson University which initiated laptop computers in 1998, where every undergraduate student would be equipped with a laptop to assist him or her in his or her academic needs (Weaver & Nilson, 2005).

The Major Impacts of the Laptops on Students and Educators

Only a few studies show that the adoption of the laptop initiative is comprised of different arrangements in terms of ownership and technical support (Barrios, 2004; Dawson et al., 2008; Finn & Inman, 2004). Some institutions of higher education require that freshmen students bring their own laptop and then provide technical support. Other campuses opted to provide a laptop for every new student where the cost is included as a contingency in tuition. There have been some cases where students make arrangements with institutions to lease a laptop every semester.

A group of investigators attempted to closely follow the students’ and teachers’ progress with the laptop initiative. A small number of these studies claimed that there is significant success in using laptops for teaching and learning (Lowther et al., 2003). Zucker and McGhee (2005) examined the impact of the laptop instruction on students and teachers for math education
and found that the use of laptops in the classroom benefited students even in different academic tasks besides math, such as student writing skills. In addition, teachers acknowledged greater access to quality online and computer-related materials, these being accessible to them in a variety of forms.

The above studies were echoed by a research conducted at State University of New York in Buffalo. Yerrick and Johnson (2009) initiated a mixed method study to learn the effect of laptops and other technologies on student learning. The study was done in a middle school in Buffalo, New York during the 2007/2008 academic year. The participants in the experimental group were two science teachers who integrated technology into teaching, plus their 500 students. The eight remaining teachers were used as a control group because they opted not to use laptops or technology in their classrooms. Interviews and classroom observations were carried out during the entire academic year. In addition, both groups participated in a required, high-stakes test called the New York Regents Competency Examination. The data from the survey were analyzed through ANOVA. The overall results from the data show that students in classes taught with technology showed a significant difference in satisfaction ($t_{719} = 2.314$, $p = 0.021$, $d = 2.31$) when compared to the classes taught without technology. Moreover, teachers reported that the use of laptops together with technology helped them improve their teaching methods. In addition, they noted that the laptop settings allowed them to prepare different teaching methods that accommodate different types of learners. Their testimony indicates that the integration of laptops inclined them to use student-centered approaches with less lecturing.

Russell et al. (2004) conducted an experimental study in a public high school of 209 students to better understand the impact of computer to student ratios in a classroom. They were interested in finding the advantages of a classroom where every student owns a laptop computer
versus a classroom where students share one laptop. The researchers divided students into three different groups: the first group of four students shared a computer, the second group of two students shared a portable computer, and in the third group every student had his or her own laptop. The researchers reported a major advantage of one-to-one student or computer ratio instruction over both other types of computer instruction. In the one-to-one setting, teachers gave less instructional guidance compared to two-to-one and four-to-one settings. In addition, one to one laptop students showed deeper and more interest every time they used a computer to do assignments than the counterpart groups.

In fall 2002, spring 2003, and spring 2004, Weaver and Nilson (2005) conducted a series of surveys of 17 professors and 616 students in 19 laptop courses to investigate the impact of computer-use classrooms. Results indicated that 48% of the students felt they learned more and participated better than they did in a traditional classroom, and 13% stated that they learned less with laptops compared to the regular classroom. Further, the same data shows that 91% of professors agreed that the laptop program motivated them to change their style of teaching. Additionally, 77% felt confident to teach with technology, while 14% were not comfortable enough to apply technology in their classroom.

In another similar study, Efaw et al. (2004) evaluated the effects of teaching and learning with laptop computers for freshmen students at the United States Military Academy at West Point, New York. This quasi-experimental study involved 10 instructors who taught 30 sections of 527 freshmen in a general psychology class at West Point. Sections were randomly divided into two groups of students to take six tests composed of short answers and multiple choice questions plus a final examination of similar composition. Six instructors were selected to teach 22 sections without applying laptops (control group). Four remaining instructors were selected to
apply laptop technology to teach eight sections of students (experimental group). The instructors used the same textbook, curriculum, and tests to assess the selected students. After the final exam, the survey was given to the experimental group to assess student attitudes toward the use of laptop instruction. The outcome of the study revealed that the students who took laptop instruction scored considerably higher on all tests plus the final exam, with an average score of 86.8% compared to 83.8% for the students who participated in traditional learning. The results were statistically different ($p < .05$).

Bonds-Raacke and Raacke (2008) conducted two experimental studies to explore the reaction of 122 students toward the use and implementation of tablet PCs within the classroom, respectively. Outcome results of this experiment indicated that students who have used these technologies experienced an improvement of interactive and student-centered learning. The results of the second experiment also showed that students have a positive attitude toward the integration of these machines in the classroom.

Finn and Inman (2004) carried out a survey of a group of alumni who graduated in the year 1998 and 2000 from Grove City College, Pennsylvania to examine the attitudes about their laptop program during the time they were incoming college freshmen in 1994 and after their graduation. The data analysis suggests that the participants had a good feeling about the program with a mean score $F(2, 207)=40.02, p<.001$), and that, based on gender, the digital divide diminished at the time they were in school, and reappeared after graduation with mean score of $F(2, 205)=14.57, p<.001$. The most recent quasi-experimental study performed in the Idaho College of Business and Economics by Hall and Elliott (2003), students and faculty who used laptops in teaching and learning reported statistically higher competency with modern software applications than those who did not use a laptop to complete class assignments.
Beyond the positive reports from the literature, there are some critics who have repeatedly questioned the way laptop technology is adopted in schools. No matter how schools have been pressured to adopt one-to-one laptop instruction, old school practices and methods of teaching are still evident in schools (Cuban, 2001). Cuban in his book *Oversold and Underused: Computers in the Classroom* repeatedly insists that the implementation of information technology into the classroom has not been utilized at the maximum level. In the same argument, he adds that technology integration is not fully utilized until it has ensured the enhancement of the learning process and achievement of curricular goals. Cuban’s views were also shared by a number of scholars who argued that several schools are not prepared to move beyond using a computer for teaching basic computer lessons or utilizing application software for tasks such as typing research papers, surfing the Internet, and receiving or sending emails (Ertmer, 2005; Young, 2006).

More to the effect of the integration of the laptop into teaching, Odhabi (2007) commented that learning with one-to-one laptop instruction will give students opportunities to improve their computer literacy and enable them to increase their study habits with peers through the use of different software. He also acknowledged that access to one-to-one computer technology will allow students to explore and share learning materials in a speedy fashion. However, he rejected the idea that requiring every student to have a laptop in the classroom will improve his or her ability to build or retain the knowledge. To motivate all learners, he encouraged learning institutions to organize a curriculum that includes social activities, such as gaming.

Effective integration of the laptop initiative in some institutions of higher learning has been found neither problematic nor simple, but a number of researchers have shown more
positive effect of usage as well as student learning improvement. In 2003, Graetz, Snyder, and McVay (2005) conducted a survey of over 2500 undergraduate students to learn about the frequency of use laptops and their perceptions of the laptop initiative at Winona State University. In this study, the results showed that students spent 50% of their overall usage of laptops to accomplish their academic assignments and frequently brought their laptop to class to take notes. In addition, students showed their interest in using their laptops to search leaning material on the Internet and to collaborate with their peers online.

Factors Influencing Successful Laptop Programs and the Potential Barriers

One of the factors that challenge the classroom setting is the introduction of the laptop initiative as a method of instructional delivery. The advocates of this medium system believe that the laptop program is an ideal tool because it allows educators to create an effective and meaningful learning environment (Hill & Reeves, 2004; Zucker & McGhee, 2005). Cuban (2001) conducted a survey in Colorado State University to assess the development of learning through laptop-based classroom settings. In the summary of his study, he concluded that laptops, as a teaching technology, can be a productive instrument that facilitates interaction, collaboration, powerful research, and technical skills that meet students’ and educators’ needs.

However, it is crucial to recognize that technology-enhanced instruction is not enough to promote learners’ skills and knowledge. In fact, the institutions that have adopted laptops have frequently expressed unique concerns and difficulties including instructors’ technology skills (Cuban, 2001; Newhouse, 2001; Warschauer, 2006; Zucker & McGhee, 2005); instructors’ challenges to manage student activities in the classroom (Ertmer, 2005); financial difficulties (Warschauer, 2006); inadequate technical support, insufficient space for all machines, distraction of Internet and social media (Hill & Reeves, 2004); and so forth. For example the University
System of Georgia officially ended their laptop program due to the sky-rocketing cost of student tuition and a bloated school budget (Georgia system ends laptop program with debt and claims of success, 2001). Warschauer noted that most schools face financial difficulties in supporting laptop cost and other budgets related to the program.

In their recent qualitative study, Dunleavy, Dexter, and Heinecke (2007), observed the classroom environment, benefits, and challenges of ubiquitous computing in two schools in a middle school located in a southern location in the United States. They collected data through class observation and interviews from two different groups of teachers, composed of eight English, math, and science teachers in order to understand the value of using mobile devices in teaching and learning. The results reveal that the one-to-one method produced valuable results such as skills for searching the Internet as well as an increase of using computer, and online communication. However, teachers expressed a major concern regarding the risk of accessing inappropriate materials like pornography and games, and were concerned about other class disturbances. On top of these challenges, the researchers noted the increased costs of laptops and the lack of professional development funds.

As Young (2006) describes in the article The Fight for Classroom Attention: Professor vs. Laptop, published in The Chronicle of Higher Education, there are a number of educators who are not willing to incorporate laptop instruction into teaching. From evidence collected in different institutions of higher learning, Young documented that professors who use laptops in the classroom wish to ban the program. In his remarks, some professors raised concerns about managing the classrooms that utilize laptops. They complained that laptops encourage class interruptions such as Internet media and online cheating. Other educators believe that using a
laptop in a classroom encourages students to turn attention away from their instructors and peers (Cuban 2001; Olsen, 2001; Young, 2006).

To overcome such problems, some universities such as Duke, have set policies to restrict the materials that distract students (Weaver & Nilson, 2005), and other institutions decided to completely ban laptop classes because of distractions and cheating (Olsen, 2002; Young, 2006). Of course other teachers feel that laptop instruction has to be well designed to counter-balance the classroom distractions. In other words, students find distractions because the instructor lacks the best methodology to engage his or her students. Frasher (2005) noted that when educators are not fully equipped with the appropriate methodology to deliver laptop instruction, the students will find a pretext to use programs that conflict with classroom instruction.

Other additional challenges attributed to laptop instruction are those related to hardware and software troubleshooting during class session. The most observed issue of this nature includes battery failure, viruses, worm proliferation, the lack of modern classroom furniture, and sufficient electrical outlets to charge the laptop batteries (Dunleavy et al., 2007). More barriers come from the fact that some teachers are not willing to use technology in the classroom because they lack exposure or have insufficient experience applying technology into the classroom (Broskoske & Harvey, 2000). Instructors may also be working without support from their colleagues, administrators, and policy makers (Levy, 2003).

As the number of institutions joining the laptop computing system has increased, technology-rich pedagogy has not gained adequate momentum for enhanced learning and teaching. In fact, it is common to hear of frequent roadblocks in laptop using classrooms (Hill, Reeves, Grant, Wang, & Han, 2002). Additional tensions are found in insufficient or nonexistent avenues for professional growth and an increase in teacher workload (Zucker & McGhee, 2005).
along with difficulty in designing appropriate instructional material (Efaw et al. 2004). Researchers have also surveyed the problems linked to limited classroom space, space which is not configured to accommodate computer desks, and also the lack of high speed Internet (Efaw et al. 2004; Hill & Reeves, 2004) as potential barriers in the classroom.

**CHAT as a Tool to Analyze Computer Activity System**

As acknowledged in Chapter 1, one of the major strengths of CHAT is its assertion that tool mediation is the center element of every activity system. Therefore, according to this view, the evaluation of the laptop as a tool should investigate not only the way it is used, but also how well it supports human activity. Cultural Historical Activity Theory is a model widely used to document and analyze the transformation of human activities, especially emphasizing the social and cultural elements. Today, CHAT is widely used to design and analyze the progress of many systems (Maguire, 2001).

Cultural Historical Activity Theory has been used as a theoretical framework to study computer use and software development. Cultural Historical Activity Theory provides a powerful analytical tool for analyzing human computer interaction compared to other learning theories (Nardi, 1988). According to Nardi, another major aspect of CHAT includes the cross cultural activities and cooperative work in the field of computer use. Kuuti (1996) proposed that the computer is just a tool that mediates humans (subject) and their surrounding environment. In his argument, Nardi stresses that the interaction aspect of a computer as a tool of mediation differs from the information processing capacity. She believes that development is the only important element of computer-human interaction. Thus, it is critical to both the subject and the community to analyze computer usage within a developmental perspective.
As an example, Barab, Barnett, Yamagata-Lynch, Squire, and Keating (2002) applied CHAT in a course of astronomy to analyze a project in which computer modeling-activities were deeply involved. The research was set up to analyze how the subject (student) uses 3 dimensional modeling software (tool) to construct modeling animations that help them in understanding the principles of astronomy. Precisely, the researchers wanted to understand how students (subject) are mediated by the by 3-dimensional modeling software and computer (tools) to learn the astronomy (outcome). More importantly, the study critically investigated two tensions that evolved in the project. The first tension arose between learning 3-dimensional modeling software and learning astronomy. The second tension that arose in this analysis came up from the fact that the teacher imposed the rules of learning and building models, instead of following class objectives. Therefore there was a tension between the class rules or norms and student learning. The outcome of this analysis suggests that the existence of the two tensions interfered with the understanding of astronomy. By understanding the effect of the arising tensions in this project, teachers were able to restructure and renovate the entire course to facilitate the learners’ understanding.

In the same perspective, CHAT can be used to analyze systems involving the use of laptop computing in educational institutions. Figure 3 shows CHAT representation of laptop computer activity in an educational setting. In this research, the laptop activity is represented by the community of educator, advisors, administrators, teaching assistants, and decision makers. The laptop activity can be elaborated as follows. The tool represents laptops and other learning technologies such as software, electrical outlets, Internet, and other related computer technologies. The subject represents the student and faculty involved in laptop instruction; the object is a symbol of the purpose in teaching and learning. The community stands for educational
institutions that take part in the laptop initiative, and the outcome represents the fulfillment of a curriculum. The reader should understand that the aim of Figure 3 is not to show or explain all items that are supposed to be in the entire laptop activity. It is intended to demonstrate how some of its elements may be crucial in illustrating similar activity.

Figure 3. CHAT representation for the laptop computer activity.

Cultural Historical Activity Theory can also influence critical decision making in addressing the tensions or contradictions that involves the new or existing activity setting. As Kuuti (1996) elaborated, every human activity does not necessarily ensure success. The real progress of an activity system can be filled with barriers and contradictions and may be difficult to overcome. Thus, CHAT can be an ideal model to analyze and predict changes or adequate solutions for laptop usage.
CHAPTER 3

Method of Research

The chapter discusses the methods used to investigate the impact of the laptop initiative in two classrooms at MIHL. The main discussion includes ethical consideration and confidentiality, the sample and site selection, focus group interviews, observation protocol and data collection, question for the interview, and validity and reliability. To end the chapter, the role of a critical friend and the summary of activities are offered.

The purpose of this qualitative inquiry was to understand the differential impact of a laptop initiative in the laptop using classroom and the non-laptop using classroom. Various strategies influencing the classroom were interpreted and analyzed through the students’ and professors’ experience. Cultural Historical Activity Theory (CHAT) was used as an analytical tool to examine the relationship between different components that compose the laptop activity in two classrooms at MIHL.

Ethical Consideration and Confidentiality

Material or data that is linked to the participants’ identity was held confidential and will not be released except by the participant approval or as indicated by law. Privacy of the participant was secured by means of using pseudonyms to let the researcher and his advisors identify the participant.
The participants’ names and any other identifying information were not linked to interview responses or the study analysis. The participant answers for every question were reported pseudonymously in the field notes. Also, information that could identify the participant was not shared with other parties not involved in this investigation. In addition, the data collected from both interviews and class observations were digitally saved on an encrypted computer drive, password protected, locked in a safe, and will be destroyed within a period of three years after the study. For the participant who decided to withdraw from the study, his or her data were not reported in the results of this investigation.

The Sample and Site Selection

The researcher collected data from participants by the means of focus group interviews and classroom observations. The researcher conducted focus group interviews and classroom observations during the winter term of the 2009-2010 academic year at Midwest institution of higher learning (MIHL). The winter term started on December 2, 2009 and ended on February 25, 2010, which was approximately 10 weeks of school. The first focus group interview occurred during the first week of the study, and the second group interview occurred a week before final exams of winter term (second quarter). The classroom observations occurred during every class session throughout the quarter. Each class session covered 50 minutes and every class met 4 times per week. The research covered a total of 44 hours of classroom observations and two group interviews from both students and their instructors. The timeline for group interviews and classroom observations for this research appears in Appendix B. The data obtained from this research include field notes for class observations and transcripts from group interviews.

Forty-four engineering students were selected from two Technical and Professional Communication (TPC) classes at Midwest institution of higher learning (MIHL). According to
Creswell (2003), qualitative inquiry requires that the researcher gain confidence and develop a smooth communication with participants. The fact that the researcher was present at each classroom meeting allowed him to become a member of sorts in both classrooms. Furthermore, such close communication increased a level of confidence between participants and the researcher.

In this research, the qualitative inquiry method was employed to answer research questions related to students’ and professors’ experiences in laptop using and non-laptop using classrooms. The section of the laptop using class utilized tablets for every classroom activity. On the other hand, the section described as a non-laptop using was not laptop free. It used laptops occasionally, for specific days.

The interview method was designed to elicit information from both instructors and students on their experiences of using laptops in the classroom. Therefore, an equal number of participants (volunteers) were selected from one laptop using classroom and one non-laptop using classroom to participate in the interviews. The participants were selected purposely from the two classrooms to maximize diversity in age and gender. All interviews consisted of open-ended questions, which allowed a wide scope of discussion between the interviewer and respondents (Patton, 2002).

There were 44 undergraduate students and two instructors, from the two sections of Technical and Professional Communication (TPC) classes at MIHL. Each section had 22 students. The participants of this study were undergraduate students majoring in various areas of engineering technology plus the two instructors. There were roughly 28 males and 16 females in both sections. All participants were over 18 years of age. The participants were selected intentionally from the two classrooms to maximize diversity in age and gender. The data from
classroom observations included all students in both classes. There was no student who declined to participate. Six participants from each class were selected to participate in focus group interviews outside of class time.

After receiving permission of the Institutional Review Board (IRB) of Indiana State University (ISU) and acceptance from the instructors who taught courses in the aforementioned programs, the researcher made arrangements with the class instructors to request students to participate in the study. The researcher explained the purpose and procedures of the study to participants. At the first day of class, the researcher took time to administer the consent forms for classroom observations and then proceeded with the recruitment of the focus groups. To recruit the participants for the group interview, the researcher presented a small poster to the students asking for volunteers to sign and print their names and return back the poster to the researcher after class. The researcher then selected a targeted sample from the volunteers to ensure diversity in age and gender. To protect the identity and confidentiality of the participants, the researcher assigned pseudonyms to each member who participated in this study. During the second class meeting of the study period, each participant in focus group interviews was requested to sign a consent form before interviews.

**Focus Group Interviews**

To explore the differential impact of a laptop initiative in the laptop using classroom and the non-laptop using classroom at MIHL, various strategies influencing the classroom were reviewed and analyzed through the students’ and professors’ experience. The focus group was selected as one of the methods of gathering data. A focus group is a small group of participants which is selected to participate in a study, typically its size ranges from four to six people (Creswell, 2008; Patton, 1990). In a focus group, the researcher has an opportunity to observe
and listen carefully to the diverse controversies, contradictions, and different opinions of participants as they emerge in the discussion. Powell, Single, and Lloyd (1996) acknowledge that the focus group is a powerful tool for qualitative research because it helps to generate strong hypotheses and systematic questions.

The focus group interviews also offer a flexible environment to gather information from a united group or with common interest at the same time during one sitting (Emerson & Maddox, 1997). This type of interview is handy when it is difficult to find a convenient time to meet separately with every participant. In addition, the same method facilitates the investigator in understanding the main meanings of the described facts. It is a preferred approach over the selection of one person because it gives the interviewees the confidence and opportunity to express their opinion in collaborative and social context (Creswell, 2003).

The focus group has been used by several organizations to assess their strength, contradictions, innovation or to terminate some programs (Patton, 1990). Focus group interviews remain a sample or market research tool where reactions to the new or existing products can be explored. Morgan (1998) studied the number of research groups needed to obtain exhaustive data or the maximum length of such interview. He recommended the moderator should stop the interview when the information starts to become redundant or after two to five focus groups. In this study, therefore, the researcher conducted two focus group interviews as recommended by previous scholarly experiments.

**Classroom Observations**

Observation is a method used to collect data by watching people in a chosen site (Patton, 2002). In this study, class observation assisted the researcher in discovering important facts left out during interviews. During every class time, the researcher (nonparticipant observer) was
looking for evidence of tensions between tools (laptops, software and assigned tasks), members of the community (students and teachers), and rules (classroom rules) as guided by the CHAT model. Additionally, the researcher was looking for confirming and disconfirming evidence with respect to issues that arose during focus groups, and to enhance the researcher’s understanding of the phenomenon that he was observing. This practice of multiple observations coupled with interviews all helped the researcher to triangulate data from multiple sources. Multiple sources can be, for example, the multiple subjects within the activity.

**The Researcher’s Role**

According to Creswell (2007), the interpretation of the qualitative inquiry combines several details including the researcher’s background and experience, context, and his level of understanding of the project. Creswell advocates that providing such detail will allow the reader to understand the connection between the interviewees’ view and researcher’s interpretation of the situation. In this investigation, the researcher was familiar with the laptop program because he was currently using laptop instruction to teach a class of 35 undergraduate students in the Department of Curriculum, Instruction, and Media Technology at ISU. He also holds a Masters’ degree in Computer and Electronics Technology and a Bachelor’s degree in Electronics Technology.

In this study, the researcher carried both roles of moderator and interviewer and gathered information from participants through informal or arranged meetings. He is also experienced and familiar with laptop instruction. Even though this was his first qualitative research experience, his teaching knowledge of laptop computing plus his advanced classwork in research method qualified him to interview the subjects for the purpose of this study.
The aim of the observations was to support the accuracy of the data findings collected through interviews (Creswell, 2008). The direct or overt observation process has been used to gain a general perception of students’ interaction with a teacher and classroom activities or laptop usage. The observation included the field notes from professors’ and students’ activities and interactions in respect to the Technical and Professional Communication course. Observational data were transcribed in a notebook and transferred to digital media for analysis.

**Interview Questions for Instructors**

- Please describe the impact of the laptop initiative on your teaching process.
- How do students use their laptops for academic purposes?
- Do students incorporate laptop technology in their classes on their own? If so, are there any barriers they run into?
- Is there anything else you need to more effectively use the laptops for instruction?
- Has having a laptop initiative on campus enhanced student’s performance in school, as well as prepared them professionally?
- Would you encourage other teachers to use laptops in the classroom?
- How much emphasis or effort do you put on laptop instruction?
- On balance, does laptop use offer more benefits or cause more problems in instruction?

**Interview Questions for Students**

- Please explain the accomplishments you have achieved in the laptop classroom initiative
  How do you use your laptop in the classroom?
- What types of support or changes would you like to see as you continue to use the laptops in your classroom?
Do you get the help you need when your laptop has problems? What do you think can be done to improve student learning and the laptop implementation in the future?

Please describe the impacts of the laptop instruction on your learning process. Would you encourage other teachers to use laptops in the classroom?

What are the major activities you use your laptop to do (in class and outside)?

Are you allowed or not to use your laptop in class to access information other than your class assignments?

Briefly explain your computer experience. What are your experiences with software you use in your classroom?

Have you used a laptop in your high school level courses?

It is critical to understand that the above questions and sub-questions are meant to obtain the needed information. As interviews progress, sub-questions may expand in order to obtain more detail of participant views. According to Morgan (1997), the focus group interviews require few questions so that the participants get enough time and freedom to express their belief, attitude and experiences.

Data Analysis

After the interviews and observations, the method of organizing the raw data of text and images was needed to get refined results. To reach this goal, the coding of data became a crucial part of the data analysis. According to Glesne (2006), there are several methods of data coding which includes thematic, conceptual, axial, and selective generative coding. She added that the thematic method is the most popular way to analyze data. In this perspective, Lewins and Silver (2007) suggest many Computer Assisted Qualitative Data Analysis (CAQDAS) software programs that are specifically designed to simplify the thematic coding. In this study, the
researcher used both NVivo 7.0 and index cards to code themes that were pertinent to the research questions.

Thematic coding in qualitative research involves different activities such as transcribing, classifying into different groups, and reporting (Patton, 2002). The first step in this process was to do a transcription which involved the way of changing field-notes and electronic recording into the readable format or as a text file. The next step was to identify the collected data that had similarities and organize them into different categories called themes. The selection of these themes was based on their characteristics, descriptions, and context (Creswell, 2009). Another step was to link themes together to form a logical coherent and reportable form. Finally, reporting the findings came after coding all categories of information was done. To accomplish this process successfully, all themes related to the study were arranged chronologically.

For the purpose of this research, the researcher followed thematic coding as described in the above paragraph. Since this study was based on grounded theory, Creswell (2008) suggested also using a technique called “emerging design.” He defined an emerging design as a protocol of qualitative inquiry that allows the researcher to collect data, and analyze it piece by piece without waiting until the end of data collection. This means that the researcher swung between data collection and analysis. According to Creswell, this design gives the researcher hints on the types of information to collect during his or her next round of data collection. Creswell has attributed some benefits to the emerging design which include:

- It helps to document the history of changes in design.
- It facilitates in keeping track of additional need and valuable information to collect.
- It also assists in improving and clarifying the information in a systematic way.
- It leads the researcher on how one can proceed to the next phase of the data collection.
Data Analysis and Interpretation Procedure

Even though this section is more elaborated in Chapter four, it is important to give the reader an overview of the analysis procedure. Initially, the researcher started with transcribing the first audio-recorded interviews. By using a coding scheme method, he proceeded by organizing bit by bit the observation field notes collected in a period of one week, stored them digitally, and password protected them in the hard drive of the researcher’s computer. After repeatedly reading the transcripts, an initial coding format was developed. This initial coding method was afterward applied to the last group interviews and the remainder of the classroom observations. Afterward, several revisions and the final coding scheme were made.

As recommended by Lewins and Silver (2007) and Tesch (1990) respectively, the researcher used Computer-assisted qualitative data analysis software (Nvivo 7.0) and some index cards to analyze the observation field notes and interview transcripts. Every card was color coded and distinguished with a different title. The researcher used the NVIVO program as a method to compare and organize similar and different themes. Based on the Cultural Historical Activity Theory approach, he carefully looked for similarities and divergences across participants’ responses. The analysis used six major coding areas: (a) the way laptops were used for instruction, (b) the benefits and drawbacks of using laptops for instruction; (c) the impacts of the laptop initiative on professional development and resource sharing; (d) collaboration between students and instructors; (e) technical support and sharing teaching resources; and (f) tensions and contradictions that emerged in each classroom activity.

Validity and Reliability

Validity and reliability are the main means to verify the credibility of qualitative research (Patton, 1990). Even though both terminologies help in evaluating the quality and rigor of the
qualitative research, the two words have different meanings. Validity is the mean of using different techniques to check the accuracy of information collected from the field and literature (Creswell, 2009). Reliability is a means of using different procedures to verify the consistency across all research steps and procedures. Different researchers offer different techniques to ensure the validity and reliability of the investigation. Creswell advise researchers to use different procedures to assure the validity and reliability of the research findings. The common procedures used to increase the validity and reliability in modern qualitative research are as follow:

- use a long period of time of data collection
- use of one or two participants to verify the accuracy of the data reporting
- use of the theoretical results to compare with the findings of the study
- use of a triangulation technique
- use of an independent auditor (who is not familiar with the study) to verify the clarity of the research
- use of honesty to report the discrepancies and the contradictions to the study
- seek a “peer debriefing” to assist the researcher in asking questions to the participants (this process helps the participants and audience see the qualitative question in different perspective)
- use of one or a group of critical friends (Costa & Kallick, 1993).

In this investigation, the researcher performed the triangulation method through two critical friends, six participants, literature, and one expert to verify the accuracy and validity of the data reporting and findings.
Triangulation is a procedure of using evidence from various sources to support themes in a research study (Creswell, 2009; Patton, 1990). Both Patton and Creswell suggested that evidence can come from an expert in the research area, different documentation, and the theoretical framework. In this study, the researcher opted to use two critical friends who were outside of the study and member checking to evaluate and validate the data analysis from group interviews and classroom observations. He also used six participants of the focus group interview to cross-validate the data reporting. In this manner, members of the group confirmed the accuracy of the researcher reporting.

**The Role of the Critical Friend**

A critical friend is a trusted individual who can provide a valuable opinion about the research and help to see the research data in a different perspective (McNiff, 2002). Critiques are vital for evaluating qualitative research. Costa and Kallick (1993) recommend selecting one or two critical friends to offer evaluation from the beginning to the end of the research.

In this research, two graduate faculty members with experience in qualitative methods were available to advise and guide the data collection and analysis. As critical friends, they were consulted at least once a week to scrutinize the analysis activities for bias and helped the researcher validate his interpretation to minimize the threats to validity. Threat to validity may originate from the use of a single method or limited source of analysis or from the bias of the moderator (Berg, 2007).

**Summary of Activities**

The method and procedures that were used in this study were discussed. The process of this investigation was clarified and valid evidences were provided to ensure the accurate results
from group focus interviews. The sampling of participants was done following the proper protocol and the triangulation method was used to increase the validity of this research.
CHAPTER 4

Data Analysis and Findings

Research Arrangement

Qualitative data from both laptop and non-laptop using classrooms of Technical and Professional Communication (TPC) at a Midwestern institution of higher learning (MIHL) were collected during the winter term session of the 2009-2010 academic year. Data sources included two focus groups, interviews from 12 students and two instructors; and classroom observations from two classrooms.

As indicated in Table 2, the laptop using class met four days per week and was taught by Dr. Tablet. Dr. Tablet is not only the professor of this class; she is also the executive director of institutional research, planning and assessment, and the coordinator of the laptop initiative at the same institution. She is an experienced educator with great passion for laptop instruction, especially the use of tablet PCs and DyKnow software.

On the other hand, the non-laptop using class was not laptop free. It used laptops occasionally, for specific days and met four days per week. The class was taught by Dr. Pen, a professor at MIHL who is also an experienced professor of English. Even though she did not put as much emphasis on laptop and DyKnow instruction like Dr. Tablet did, her classroom
organization was unique. More details describing the classrooms under investigation are available in Table 2.

All participants in the classroom observations and focus group interviews were willing to participate in this investigation. They were very excited to talk about laptops or tablets computers, but the feeling was a little different when it came to the issues of application and experiences using laptops for classroom instruction.

**Classroom Observations and Focus Group Interviews**

The laptop using class and non-laptop using class of TPC course were observed 22 times each. All classroom observations were conducted by the researcher. Each classroom observation took about 50 minutes or one classroom session. The classroom interviews began during the first week and ended one week before final exams. Classroom observations focused on how students and instructors (subject) used laptops (tool) to accomplish class activities (object). Specifically, the researcher was interested in (a) the way laptops were used for instruction, (b) the benefits and drawbacks of using laptops for instruction; (c) the impacts of the laptop initiative on professional development and resource sharing; (d) collaboration between students and instructors; (e) technical support and sharing teaching resources; and (f) tensions and contradictions that emerged in each classroom activity.

The instructors who taught these sections were interviewed twice. Two groups of students, one group from each section, were interviewed. There were a total of 12 students or 6 students per group and two focus group interviews as shown in Table 2. The first focus group interview was held during the beginning of the winter term and the second one was made toward the end of the quarter. There were eight males and four females, but one male dropped before the end of the study. His answers and name were not included in this analysis.
As indicated in the methodology section, participants from focus group interviews, two critical friends, books, and articles from peer-reviewed journals were used to verify the validity and reliability of the findings (Creswell, 2008). After these verifications, minor collections were made and the summary was done. Figure 4 illustrates the sequence of the research activities.

**Course Description**

The Technical and Professional Communication class is a general-education course designed for engineering students at the junior level at MIHL. The course was designed to equip
engineering students with communication skills needed to collaborate with different people effectively. During the first interview, Dr. Tablet clarified the main goal of this class as follows, “...We train engineering students who are going to be collaborating with people, not only in other states, but also around the globe and they need that experience...” During the winter academic quarter 2009-2010, this course was taught in eight different sections, by four different instructors. However, the focus group interview and classroom observations were conducted in different sections, one taught by Dr. Tablet and one taught by Dr. Pen. Table 2 illustrates the breakdown of each class.

Table 2

Breakdown Details for the Laptop Using and Non-laptop Using Class

<table>
<thead>
<tr>
<th>Meeting Day</th>
<th>Time</th>
<th>Section</th>
<th>Instructor</th>
<th>Number of Students</th>
<th>Number in Focus Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday, Tuesday, Thursday, and Friday</td>
<td>9:50 am.</td>
<td>laptop using</td>
<td>Dr. Tablet</td>
<td>22</td>
<td>6</td>
</tr>
<tr>
<td>Monday, Tuesday, Thursday, and Friday</td>
<td>10:50 am.</td>
<td>non-laptop using</td>
<td>Dr. Pen</td>
<td>22</td>
<td>6</td>
</tr>
</tbody>
</table>

Instruction and Technology Set Up

For the benefit of the reader, it is essential to give a brief description of the main learning materials and activities for both classes. The two classes indicated in Table 2 were taught the same content and both shared the same syllabus. The main purpose of both classes was to enhance students’ communication skills particularly in the context of an engineering setting. Both classes used the Angel Learning Management System as a primary electronic depository to
store course document samples, assignment sheets, evaluation forms, quizzes, and rubrics. However, two classes used different methods of delivering instruction.

The section described as laptop using put more emphasis on the use of tablet PCs and *DyKnow Vision* software to enhance instruction. The class was totally paperless; students and instructor used tablet PCs, pen-based computing (stylus), and DyKnow software for teaching and learning. Students in this class did not bring their own laptop because the classroom was equipped with HP EliteBook tablet PCs. Tablets have a stylus, loaded Windows XP Professional, and DyKnow Vision 7. The class focused particularly on collaborative learning, hands-on activities, and peer review. Besides DyKnow Vision, members from Dr. Tablet’s class used other types of software and Web 2.0 platform to effectively share class resources outside of the classroom.

The section described as a non-laptop using was not laptop free. However, the instructor did not put emphasis on the use of DyKnow software like the other section. Students were supposed to bring their own laptops on certain days and other days they did not need to bring them. Dr. Pen used mainly traditional pedagogy, laptop, and projector and screen to deliver instruction. The Angel Learning Management System was used as the main depository system for classroom materials such as scoring rubrics, data sheets, and other class documents. Email was also used as the main tool for communication outside of the classroom. When the researcher asked whether the laptop was used in teaching and learning, Dr. Pen (January 15, 2010) explained, “We do not use laptops every day…I’ve indicated on our syllabus schedule which days the student should bring the laptop to the classroom.”
Findings

The researcher carefully revised field notes, transcribed interviews from focus groups, and coded major themes according to the grounded theory method of data analysis. The researcher used both NVivo 7.0 and index cards to code themes that were pertinent to the research questions. Several coding revisions were made to find the common themes that appeared in both interviews and classroom observations. As analysis of each individual classroom was completed, data were compared to identify similarities and differences among tensions. Contradictions or tensions were identified and analyzed according to the tool-mediated activity as presented in the CHAT model (Engeström, 1987; Nardi, 1996).

From the collected data, five major themes were identified: (a) experiences of laptop usage; (b) benefits and drawbacks of the laptop for teaching and learning; (c) the impact of the laptop on professional development; (d) tensions and contradictions that emerged in laptop activity usage, and (f) technical support and sharing teaching resources.

The laptop usage emphasized the ways students and instructors utilized laptops or tablets PCs for learning. The usage of laptops for learning and teaching included information and statements related to the instructors’ and students’ experience and the role of technology in the classroom. The benefit or drawback of laptop usage highlighted those items which impacted student learning either negatively or positively. The impact of laptops for professional development and resource sharing focused on different activities that help the instructors to better integrate laptops into teaching. The internal contradictions and tensions were defined according to Engeström’s model, specifically the activity theory.
The above themes addressed the following research questions:

1. Briefly explain your computer experience. What are your experiences with software you use in your classroom?

2. Please explain the accomplishments you have achieved in the laptop classroom initiative. How do you use your laptop in the classroom?

3. Do students incorporate laptop technology in their classes on their own? If so, are there any barriers they run into?

4. Would you encourage other teachers to use laptops in the classroom?

5. On balance, does laptop use offer more benefits or cause more problems in instruction?

6. What are the major activities you use your laptop to do (in class and outside)?

It is important to clarify that additional answers connected to other research questions are embedded in this section of the research.

In the following section, the researcher first clarifies how laptops were integrated in instructional practices and how such integration played different roles in instructors’ and student’s academic experiences. Specifically, the researcher describes sequences of activities that occurred in each classroom and then puts the findings in terms of Engeström’s triangles that represent an activity system. Since every activity system is characterized by inner tensions, the next step is to apply CHAT as an analytical tool to explain those tensions and some methods used to minimize or reduce such tensions. Lastly, the section ends with a summary of activities.

Experiences with Laptop Usage

The results from collected data indicated that participants in the investigation used laptops differently. Throughout the quarter, Dr. Tablet’s class used tablets and DyKnow for the
activities that fostered student-centered learning and problem solving. In the non-laptop using class, Dr. Pen used traditional teaching pedagogy and requested students to use the laptop on a specific day. In another words, laptops were not the center of teaching and learning. They were mainly used for certain tasks for special purposes. However, both laptop using and non-laptop using classes were centered on team collaboration and focused on various examples related to engineering communication.

The tablet PCs or laptops loaded with different type of software applications such as DyKnow Vision, Angel Learning Management System, Microsoft OneNote, and PowerPoint were instrumental for group collaboration. Additionally, the presence of the laptop and projector and screen allowed both professors to add visual materials into instruction. Likewise, laptop technology brought a wealth of instructional resources into the classroom through the wireless Internet. Instructors could locate excellent online materials and apply them into their lessons by using a computer projector in class. When the researcher asked both instructors which main activities the class had achieved with laptop computers, Dr. Tablet emphasized that the tablets were the vehicle for student collaboration. She further commented:

…The presence of a laptop linked in student minds that my class is related to engineering classes rather than being something distinct, not important, sort of a visual cue... when students are in my class they use the tablet PC to do different classroom activities... for example, I put students into groups and perform some kinds of tasks or exercises…they could be…creating a data graph, [or] redesigning data graphs to make them more effective and clear. They also use a tablet to conduct peer reviews for each other’s documents. By using the network functionality, students also can reach other’s documents, they can open it in Word and use reviewing tools in Word to annotate them,
make corrections, and make suggestions. They use it also to communicate with me. They communicate with me in class by sharing their tasks with me or some type of activities in class or they communicate with me outside of the class. (Dr. Tablet, January 18, 2010)

Her class took advantage of the pen-based computing of tablet PCs and DyKnow functionalities to share technical communication skills, collaboration, peer review, notes, and group presentations. For example, Dr. Tablet would put students into groups to perform hands-on tasks or exercises such as drawing graphs, tables, engineering diagrams, peer evaluations, quizzes, and PowerPoint presentations. In her comments, she also pointed out that her students use laptops to access documents that otherwise would be impossible without technology. Sometimes, she might ask students to collect the information from a website, organize such information in a Word document, and submit the final product in DyKnow.

For example, on January 12, 2010, Dr. Tablet facilitated a group project that involved analyzing mobile-phone information. She asked students to go online and search different information related to mobile phones. Her teaching objective was to have students analyze different brands and convert that knowledge into charts, diagrams, and tables all placed skillfully into a PowerPoint Presentation and then to submit their findings through DyKnow using “Fundamental Principles of Analytical Design” by Edward Tufte. While the instructor was walking around the room answering questions, students worked in small groups using online databases and search engines to find the information related to different brands of cell phones. After submitting the assignment into DyKnow, the instructor retrieved slides immediately and the entire class took the opportunity to evaluate each other’s group’s work. At the end of the discussion, both students and the instructor had an opportunity to discuss the advantages and disadvantages of using cell phones. At the end of the class, students were cheerful, energetic, and
enthusiastic. The above example shows how students had an opportunity to use Internet tools to coordinate classroom activities and stay engaged.

On January 17, 2010, the laptop was also used in Dr. Pen’s class to explain how graphics can be used effectively in PowerPoint presentations. Dr. Pen assigned a group assignment to search for information related to design principle for PowerPoint slides. She provided a website “www.writing.engr.psu.edu/slides.htm” where students were to access an alternative model for improved PowerPoint slide design. To initiate the activity, the instructor provided typical examples of common mistakes found in PowerPoint which included a tendency to use many words on a single slide, many bullets, and have an absence of visual elements. After providing an example, the instructor had groups work in pairs to revise former slides according to the new template and submit the final results into the Angel Learning Management System. The collaboration went smoothly, students shared ideas, and teams assisted each other.

Similarly, tablets or laptops were also successfully used for showing visuals such as graphics, and movie clips related to the class topic. On Martin Luther King Day, Dr. Tablet showed a video clip of King’s speech to explain the effectiveness of using communication principles (logos, ethos, and exigence). After watching the video clip, students gave different reflections and comments about the speech. On the next class day, she also used a graphic from Stalin’s army parade to show an illustration of how Tufte compared the design replicate principles to Soviet dictatorship. In this class, students not only had the opportunity to collaborate with peers, but also assumed different roles, asked questions, and analyzed technical data from different perspectives.
All of these activities helped students stay focused and they were not tempted to access social media for inappropriate activities. Sophie, a student from the laptop using classroom commented on the major activities her class achieved with laptops;

We use it [laptop] to do assignments and turn it in…sometimes we create slides to turn in DyKnow Vision and we can compare notes with our classmates…we also use the tablets to get video clips from the Internet when the professor wants to illustrate what we are doing in class. (Sophie, January 15, 2010)

Her classmate, Scarlet also gave more clarifications on specific applications,

It is convenient to follow the professor and take notes. I also like the fact that I can open a copy of a document and write or edit on DyKnow which is better than having a hard copy. You can use it for DyKnow reviewing tools to edit notes. It is easy and convenient because we know we have all of the notes on the network. (Scarlet, January 15, 2010)

Further, the interactive method of teaching through gaming was applied in the laptop using class to explain main points. Group activities were assigned in DyKnow where students played kinds of games that illustrated the engineering or technology communication principles. This method attracted student’s interest at the same time they focused on their class assignment.

The report *Using Technology to Support Education Reform*, published by the U.S. Department of Education, Office of Educational Research and Improvement (1993), revealed that gaming and simulation help learners to increase motivation and are a source of meaningful learning.

Likewise, Wenglinsky (1998) in his article *Does It Compute? The Relationship between Educational Technology and Student Achievement in Mathematics*, insisted that simulation and gaming can motivate children to perform exceedingly well in math and science. In the context of
this research, gaming was thought to be introduced to students to explain their thoughts by
developing a better understanding of communication concepts.

On January 25, 2010, another laptop-integration scheme was introduced in the laptop
using class to describe the topic of “Expert Source Work.” Dr. Tablet assigned a game called
“Bingo” to different team members. Students played the game using the bibliography document
to label the intended topic. At the end of the game, students submitted their answers though
DyKnow panels. The game sparked an engaging discussion and questions attracted students’
interest in learning the lesson. The above illustration shows clearly that the combination of
instructors’ creativity and the presence of tablets and DyKnow initiated meaningful learning and
student excitement.

Unlike Dr. Tablet’s section of TPC, Dr. Pen explained why her students did not utilize
the laptops on a daily basis. She felt she maximized the effectiveness of the laptop by not using it
every day. In her explanation, she indicated that the days she did not require laptop usage,
students stayed focused on their activities and were less distracted. From her point of view, a
laptop was not necessary as a tool for motivation, but rather tended to be a distraction. However,
she further commented that laptops helped students stay focused on collaboration activities
particularly in active writing and research projects. In her explanation, Dr. Pen expressed
concerns about the minimum usage of laptops in her class. She believed that she did not utilize
laptops to the maximum level compared to other classes on campus because of her limited ability
to use it in the classroom. In our first conversation, the instructor indicated that she tries to bring
other types of experiences into the classroom in order to balance the material students do not get
from laptop instruction. In her response on how laptops were used in her class, Dr. Pen
remarked,
I think that the use of the laptop is so widespread at [college name] that for me when I make a choice not to use it every day, I actually feel like I am going against the norm … I am providing students with a different kind of experience to balance other experiences they are getting in other places. (Dr. Pen, February 15, 2010)

On the other hand, Dr. Pen had mixed feelings about laptop instruction during our second interview. She indicated that the laptop could be not only a good tool, but also a distraction. She acknowledged that there are some activities which are relevant to the laptop instruction and others which are just there to demotivate students, especially when the instructor does not have high computer skills. She said that sometimes her laptop instruction was not motivating her students due to her limited computer skills. However, in her statement, she indicated her commitment to getting more training with computer software and utilizing more technology in her instruction than she did before. Dr. Pen explained the difference between using a laptop in the classroom and not using it.

…What is important is the work they [students] can do with it outside of the classroom. If they do not use it outside, they cannot produce the kind of work they did, like posters…They cannot do much if they were not to use the computer and software effectively outside of the classroom. (Dr. Pen, January 15, 2010)

From the above response, you can see clearly that Dr. Pen’s students used the laptop more to complete schoolwork outside of her class. The instructor’s comments also reveal that a laptop was not necessarily a favorite tool for engaging students. This explained the main reason Dr. Pen preferred using laptops on specific days.

During classroom observations, the researcher noticed that Dr. Pen distributed handouts to students and wrote some highlights of what she would cover on the white board. In addition,
she used the projection screen to present her notes or show some data from the Internet. When she was asked to give her preference between teaching with laptops or without, Dr. Pen commented,

There are always differences…sometimes I find it hard to engage students with laptops because of my own limited ability to do multiple tasks at the same time…I also feel like they [laptops] distract my attention from students sometimes. And of course there are temptations to be distractive. For some activities, it helps to engage them [students]. There some kind of days I like to use them and there are other days I do not like to use them. (Dr. Pen, January 15, 2010)

Towards the end of the quarter, Dr. Pen also noticed that her laptop instruction improved every semester and her TPC class had accomplished more activities than ever before. In our conversation, she mentioned that the laptop facilitated students for preparing class presentations, writing projects, communication, and Internet searching. However, some activities were done better without using a laptop. For example, the instructor indicated that students did a better peer review compared to the previous quarters because they used pen and paper. Dr. Pen clarified the difference between using the laptop and traditional teaching to accomplish some activities,

…They [students] did a good job for example on peer review. They gave each other good feedback on their documents…let’s take a peer review we did in last class for instance, they did all hard copy and I feel they gave each other better feedback because I think they concentrated on the content and not getting distracted by the technology. (Dr. Pen, February 15, 2010)

Furthermore, Dr. Pen thought that there were fewer difficulties in using laptops compared to the previous years when professors spent time explaining how a computer works. She
mentioned that nowadays students can use a computer better than professors do meaning that her role is not to teach software usage, but as a technical communication professor.

In both sections, student participants also informed the researcher that the laptop was useful for editing documents, Internet, sharing notes, and saving or retrieving documents on computer networks. Students reported a similar role of the laptop in both laptop using and non-laptop using classrooms. Leopold (January 15, 2001), a student from the laptop using classroom commented, “We sometimes use it [tablet PC] for group work. We can keep notes and collaborate at the same time.” Then Data said, “We use it for communication [email]. It also helped us very much when we were learning Maple.” Mikaela (January 15, 2001), “Dr. Tablet uses it for class outline each day, practice on exercises on tablet, and taking notes.”

Yet, there was a general concern with using tablets or laptops in TPC. When asked about the use of laptops in the laptop using class, all students in the focus group responded unanimously that they preferred using laptops or tablets for the science and engineering classes rather than using it for other humanities with the exception of Dr. Tablet’s class of Technical and Professional Communication. In other words, DyKnow and tablets are not ideal for more theoretical classes where learners work with words and pictures. Students from the focus group also expressed their experiences of using laptops for other courses. Sophie (January 15, 2001) said, “There are some classes I do not want to use it [laptop], but in Tech Com. [Dr. Tablet’s section], it works really well.” Leopold also supported her claim,

It can work very well with humanities courses, but can be harder in engineering classes without it…In engineering courses it is definitely helpful when they have a white board…You can follow really quickly on white board, but on tablets, it is hard to follow. (Leopold, January 15, 2010)
Data, another student from non-laptop using class expressed the same experience,

I never have been in a kind of classroom like that [TPC]. I like the way the laptop was used in learning how to use Maple which is incredibly complicated…having laptops also helps us to learn program like OCRi [programs for tidal data assimilation] and ASPEN [engineering software for designing electric utilities]… these are kind of programs we are going to be using a lot. (Data, January 15, 2010)

The laptop was also a great tool for entertainment for some students. A number of students from the non-laptop using class were excited about using laptops for Facebook, sending emails, surfing the Internet, playing different games, and listening to music. As the researcher continued to inquire about typical distractions associated with laptops, Henry (January 15, 2001) reacted, “When I am bored I can look for some activities, Facebook, and some interesting sites.” Data expanded on Henry’s reaction,

Sometimes I use it to email people, even those who are seated around me, and I can open up many windows at time…when a professor works around the class or behind me ...I can very quickly minimize them. I have tabs for email, another one for Facebook, and for class. (Data, January 15, 2001).

Learning and Teaching Outcome, Advantage and Drawbacks

Findings indicated that the use of tablet PCs and laptops benefited teaching and learning in five major areas. The most benefits cited by participants included motivation for doing homework, communication between students and instructors, interactions with peers, confidence for their future career, note-taking, and a tool to show visuals.

Overall, participants in the focus group agreed that laptops or tablets were mostly beneficial for completing activities outside the classroom. Students indicated that having a laptop
everywhere and all the time on campus has provided them advantages, especially to easily communicate with professors and complete assignments after classes. In addition, the Web 2.0 platform facilitated meaningful communications and preparation for their poster presentation. It appears that students were able to access different web materials than if they were expected to physically use the library facilities. This convenience may actually have increased student productivity. Students could carry their laptop around and access relevant information and continue working on their discussion out of class. Leopold said that he could use his laptop after class to contact the professor in case he wanted to ask questions related to the class assignments.

Another advantage reported by participants in the laptop using classroom was the panel sharing among students. The instructor was able to use real-time monitoring through DyKnow panel to find out if students understood class activities. The researcher also observed great peer collaboration and remarkable assistance from the instructor through the use of DyKnow. Scarlet (January 15, 2001), one of Dr. Tablet’s students, clarified, “DyKnow is kind of cool software because the professor can navigate several screens to illustrate different activities at the same time.” In the same perspective, the instructor could easily use laptops to figure out students who did not complete the assignment or who did not pay attention to instruction. Dr. Tablet gave an example of how the computer was handy for classroom evaluation and assessment,

…Angel allows me to collect data; it also shows me when a student has not been able to open a document, this happened last week. I was able to show data … less than half of the class did not open up the grading rubric for the assignment and did poorly on this assignment. (Dr. Tablet, January 18, 2010).

Thus, the presence of the tablet allowed the instructor to assess and engage students in meaningful learning.
Following the above comment, the researcher wanted to know if the laptop initiative impacted student enrollment or dropout rates. Both instructors indicated that there was no clear link or evidence between the increase in enrollment, retention, and laptop initiative in their classes or at MIHL. They also mentioned that it is not common to see students dropping out of classes at MIHL.

The presence of the laptop gave instructors the opportunity to deliver course materials that could not be achieved through the use of traditional lecture. Also, using laptop computers in this course stimulated the interest of students in learning new techniques that will help them in other senior classes that require computer skills. Dr. Tablet, the instructor of the laptop using classroom, expressed the benefits of using tablets and DyKnow,

Let me start with what happened outside of the classroom first. I think the presence of the tablets and DyKnow does increase student engagement with the material that they are not predisposed to like … I can make the class much more hands on, much more active, and it [tablet and DyKnow] helps me teach a difficult subject…These students are supposed to apply what they learned in Tech Com to the senior design classes…They also learned how to write reports, meeting minutes, they work with clients; so all that is supposed to come to play. Where I see the best evidence of this is not only in the senior design after the student graduates but I have alumni who send me an email and they say “maybe I was not the best student in your Technical Communication and now I am working, now I need to have a communication every day, now I realize how important the audience is” that really where I see it paying off for them. (Dr. Tablet, March 1, 2010)

As the data reveals, students also thought that the use of tablets or laptops was a great asset for their professional career. They appreciated the fact that the institution was exposing
them to the type of skills needed in getting better jobs. Student confirmed their positive feeling about acquiring skills; Sophie (February 18, 2010) posited, “It [laptop instruction] will help us in future activities, especially for jobs that require computer skills.” Leopold (February 18, 2010) added, “It will help us get an internship because we are introduced to a new technology.” Christy (February 18, 2010) continued, “…In term of using DyKnow, it is going to help in our professional careers.”

While laptop computers were essential for the laptop using section of Technology and Professional Communication class, it was not the case for members of the non-laptop classroom. Every participant from the non-laptop class section indicated they did not like laptop instruction. For the question of comparing the benefits and disadvantages for using laptops, Dr. Pen reported,

I would say there are more benefits overall. Especially in a class focused on active collaboration among students … I think that it is partly my comfort level and my teaching style…maybe other professors can use it every day and keep students just as engaged. But for me, I feel like it sometime interferes with my eye contact with them, my awareness of how they are reacting. So, I think I function better without using it every day, too. (Dr. Pen, January 15, 2010)

Unfortunately, all students did not show a positive attitude toward the use of laptops for teaching, collaboration, and note-taking. Participants from the non-laptop using class found it difficult to use laptops while working in groups. They found it challenging to take notes and share ideas at the same time. Some participants in the focus group, mostly from the non-laptop using section, stated that laptops were not necessary for this class. Four students out of a group of six students from the non-laptop classroom responded that the laptop was a potential distraction for this particular section. They admitted using Facebook, watching weather, sending
email, and IM or studying when they brought their laptop to class. However, the researcher did not observe most of these claims and did not share the same views.

Some students also preferred using paper and pencil to take class notes, though they favored when the instructor applied technology to enhance their learning. Here are some statements from participants regarding the drawbacks of using laptops, Henry from the non-laptop using classroom stated,

In classroom [the non-laptop using classroom], if the instructor wants us to bring a laptop and she wants to put everything on a projector; why she does want me to bring a laptop? …I think this will be an excuse for us to not pay attention or fall asleep...or an opportunity not to pay attention. (Henry, February 14, 2010)

His classmate, Geoffrey (February 18, 2010) expressed the same idea, “It would be easier to do class without the laptop in this class anyway.” Beta (February 18, 2010), from the same classroom, supported his classmates, “I do not think that the laptop has been useful inside of the classroom for Tech Comm… It was useful for completing like the assignments outside of the class.”

**Impact of Laptops on Professional Development**

Besides classroom advantages, both instructors also expressed that the laptop initiative benefited the faculty members in terms of the professional development. The institution has stepped up the initiative to allocate funds for faculty development. All faculty members are now equipped with laptops or tablets. They also have access to modern teaching resources such as DyKnow and other engineering application software. Research has shown that professional development is a valuable strategy for encouraging faculty to integrate successfully the laptop instruction into teaching (Penuel, 2006; Fairman, 2004; Lowther et al., 2003). At MIHL, the
institution has increased the effort in supporting faculty who are willing to embrace the journey of integrating technology into teaching.

In her role as director of institutional research, planning and assessment, Dr. Tablet informed the researcher that she has been successful in securing money for training faculty members and redesigning courses to fit DyKnow applications. As a result, Dr. Tablet asserted most faculty members see the tablet or laptop as an effective teaching tool for engineering, math and sciences, and technology communication. Furthermore, most faculty members are engaged in learning more computer skills that will allow them to apply computer instruction within their instruction.

**Technical Support and Sharing Teaching Resources**

One of the impacts of the laptop initiative at MIHL is the major transformation of computer technical support. Technical support plays an important role in assisting students and faculty to maintain efficient and effective teaching and learning. According to Dr. Tablet, servicing laptop computers is no longer as much of a heavy burden as it used to be or as it is in other institutions because of the knowledgeable technical staff. She added that it became a much simpler task when the institution decided to have all laptops share the same hardware and software. Dr. Tablet also informed the researcher that the technical support team usually assists students in fixing their computer problems because every machine has a warranty of four years. In case a laptop has problems, students have an option to get a loaner laptop until the Help Desk fixes the broken one. The second option is to remove the hard drive of the broken laptop and put it in the loaner computer until the other one is fixed. Dr. Tablet indicated that reactions from instructors and students demonstrated for her how pleased they were to have a very knowledgeable help desk staff.
Dr. Pen (January 15, 2010) recognized the importance of the technical support
mentioning, “We have someone in the audiovisual department for technical support and who is
available to help on that …They have student workers as well… I think the technology is getting
better.” Dr. Tablet responded with a similar statement,

We do the servicing of our laptops in house and I think this is a really important
difference… I talk with other people on other campuses; mostly they have an office
where they ship the laptops or computers away. We fix ours, and loaner laptops are
available, if a student needs one… they [technical support] can remove a hard drive from
a student computer and put in a loaned machine and the student is ready to go. (Dr.
Tablet, January 18, 2010)

In recognition to the technical help, students also agreed with instructors’ statements, Geoffrey
commented,

For the hardware, the team from [the Help Desk] usually comes to help…when you buy a
computer with MIHL; you have a four year warranty with the institution. When your
computer has a problem, you take it to [the Help Desk] and they fix it for you. For
software also, the technical support people are very good. They are “techy”, I think.
(Geoffrey, January 15, 2010)

Besides audiovisual and Help Desk support, students majoring in computer science have
played an important role in helping their friends fix laptop problems. There were some
acknowledgements from the participants when the researcher asked a question regarding
technical assistance. Data (February 18, 2010), a student from the non-laptop using classroom
added, “We get help from other students or seek help from the Help Desk.” Then Larry
(February 18, 2010), a student from the non-laptop using classroom agreed with Data’s
comment, “We have also computer science majors who can help. You may need, for example, to ask your roommate or a friend to assist you in downloading some programs or fixing some software issues.”

In Dr. Pen’s class, for example, students volunteered on several occasions to assist her in solving problems related to computer software. During a classroom observation, the researcher noticed that some students helped Dr. Pen to solve minor technical problems on her laptop computer or sync her laptop to a projector. When asked who helped the non-laptop class in solving technical problems, Henry (February 18, 2010) from non-laptop using classroom explained, “There are always smart students in class who can fix laptop problems.”

Contrary to the non-laptop using section, Dr. Tablet solved technical issues related to DyKnow Vision, Angel Learning Management System. The Help Desk rarely comes to assist her in technical problems. She also acts as consultant with the use of tablets, DyKnow Vision, and Angel Learning Management System. Her office is in charge of servicing tablets. They ensure that all tablets and software are updated and function well. In addition, she encourages other faculty members to use the tablets, DyKnow, and Angel. When the researcher asked Dr. Tablet to expand upon her motivational techniques used with her fellow faculty members she said,

We do share pedagogies and strategies. When a new version of DyKnow comes out, we talk about the new features and how we are going to use those…I would post an article and send email to them…So we try to keep things connected. (Dr. Tablet, March 1, 2010)

For the question regarding the factors that encouraged her or some of her colleagues to use laptop instruction, Dr. Pen and Dr. Tablet acknowledged that all depend on the willingness and commitment of each faculty member. They also pointed out that some educators need more time and professional development to allow innovation in their teaching methodology. As to the
probing question related to the factors that may hinder a faculty member from using laptops in
the classroom, Dr. Tablet commented,

I realize that for some people to make that leap, they would need professional
development, time, and money to do it. I did this on my own because it is what I was
interested in. I think it can benefit our students significantly for that class [TPC] in
particular. But, not everybody feels this way…. (Dr. Tablet, March 1, 2010)

However, the task is still difficult due to the fact that some faculty members are reluctant
to integrate technology into teaching. Even though MIHL is an engineering institution, there are
some students and faculty who are developing basic computer skills. Some of them barely know
how to operate the computer. Dr. Tablet added the following notes concerning the initiative of
learning how to use a computer,

…You would think that in every engineering school, every student will know how to use
technology. They [some students and faculty members at the institution] own a laptop,
they own a very high end HP workstation and you would not believe a number of them
who would barely open a Word file, but still do not how to set margins, change the font,
or use the reviewing tools. There are a number of them who probably cannot … perhaps
because there is a half of the faculty who use Angel as part of the class, but [there are]
students who do not know how to work in Angel. I mean it was amazing to me how anti-
computer technology engineering students could be, engineering faculty could be. I
assume the opposite; they could all be so adept at using technology or a computer. But, a
computer is not the same thing as an internal combustion engine. Where our breakdown
is, technology is so different…in your field, you might be using a wrench to remove a
spark plug or upper intake, but this does not mean you are going to like using a computer.

(Dr. Tablet, January 18, 2010)

As a director of research, Dr. Tablet was encouraged because she has seen a growing number of faculty members who work hard to incorporate laptops in their instruction. She signaled that those who are successful are so because they are always engaged in seeking advice from people of common interest. They also share different pedagogies, from DyKnow software to tablet application. They have managed to achieve success in using laptop instruction through professional development like attending conferences, writing, and publishing papers together.

**Cultural Historical Activity Theory Interpretation and Analysis**

The main goal of this study was to use CHAT as the theoretical framework to analyze the impact of using laptops for instruction in two classes of TPC at MIHL. Engeström’s (1987) triangle was used (Figure 5) to illustrate the relationship between components of the main activity (the use of laptops in two sections of TPC class).

![Figure 5. Triangle that illustrates laptop activity system at MIHL.](image-url)
Using CHAT as a theoretical model and analytical tool, the researcher examined the relationship between subject (students and instructors) and object (laptop instruction) as mediated by the main components that constitute a laptop activity (a) tools (technologies), (b) division of labor (team collaboration), (c) rules (informal, formal), and (d) member of community (peers).

Subsequently, the model was intended to represent and analyze contradictions and tensions which emerged within or between different components of the activity system. It is critical to understand that there is no activity system that is tension or contradiction-free (Engeström, 1987). In this investigation, the researcher focused on those tensions that were persistent to the laptop activities in non-laptop using and laptop using classrooms. Specifically, the researcher was interested in describing those tensions that may lead to a disturbance of the student reaching the intended learning outcomes.

According to Engeström (1990), tensions refer to the inner struggles that contradict the common functionality of different components within human activity. Understanding the existence of tensions and their relationship to components of the activity system represents a driving force towards transformation and innovation (Avis, 2007; Barab et al., 2002; Engeström, 1987; Nardi, 1996). Although tensions are seen as a source of ongoing development, they can also reflect a source of disturbance if they are not reevaluated.

**Contradictions and Tensions**

In this study, the researcher used the mediational triangle to explore tensions that emerged within two different sections of TPC classroom activities. Even though there were a number of contradictions, the researcher only analyzed those tensions that appeared repeatedly within the laptop activity. As mentioned previously, the researcher identified recurring tensions
through field notes from focus group interviews and classroom observations. In addition, the researcher used a CHAT model and related studies that focused on similar activities (Avis, 2007; Barab et al., 2002; Engeström, 1987; Nardi, 1996) for tension analysis and interpretation.

The major tensions that arose from interviews and classroom observations were classified in 3 different categories, as indicated in Table 3, Table 4, and Table 5. The three tables illustrate the most dynamic and persistent contradictions of the classroom activity in the two separate sections of the TPC course taught at MIHL during the winter term of 2009 - 2010. Table 3 explains tangled tensions that existed in the laptop using class. Likewise, Table 4 illustrates tangled tensions that emerged within the non-laptop using class and Table 5 summarizes stand-alone tensions that existed within components of both classrooms.

Table 3

*Tangled Tensions that Emerged in Laptop Using Class*

<table>
<thead>
<tr>
<th>Segment (s) of Activity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension between learning a new tool and learning in TPC (See Figure 7).</td>
<td>Introducing a new tool (tablet) of mediation in the laptop using class created a conflict between learning how to use technology and learning the intended course objective (TPC).</td>
</tr>
<tr>
<td>Tension between subject and tools (See Figure 7).</td>
<td>Subject (students) also had difficulties dealing with peripherals of the new tool (a tiny tablet screen, clouded keyboard, and stylus). As a result, subject used too much effort to finish tasks (object).</td>
</tr>
<tr>
<td>Contradiction between the old and new way of doing teaching and learning.</td>
<td>Consequently, students suggest that the instructor writes notes on the board and be able to have more freedom to write notes on a paper (The frustration from the new tool reminds students of a different way of solving a problem).</td>
</tr>
<tr>
<td>Tension arose between users and rules.</td>
<td>Students do not use social media in the classroom because they fear the negative consequences of failing the class or being suspended from the institution.</td>
</tr>
</tbody>
</table>
Table 4

*Tangled Tensions that Emerged within Non-laptop Using Class*

<table>
<thead>
<tr>
<th>Segment (s) of Activity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension between learning how to use tool of mediation and learning TPC (See Figure 8)</td>
<td>Technology (laptops, projector screen) set up took a long time in the non-laptop using. As results, class members had pressure to accomplish activities within 50 minutes</td>
</tr>
<tr>
<td>Tension arose between the old and new way of doing an activity.</td>
<td>In vacillating between traditional teaching and laptop instruction, students were left confused. According to participants, the laptop created a distraction and conflicted with their learning.</td>
</tr>
<tr>
<td>Tension existed between subject (central), tool (See Figure 8), and the nearby activity.</td>
<td>When students were not engaged or not able to follow the instructor on their laptops, they found distractions through the use of Internet media. The laptop became a distraction for students.</td>
</tr>
<tr>
<td>Tension arose between subject (students), rules (classroom norms), and community (peers, classmates). (See Figure 8)</td>
<td>Even though students were not supposed to use the laptop for non-classroom activities during class, students watched social media. This took away students’ attention from learning and sometimes distracted their classmates.</td>
</tr>
</tbody>
</table>

Table 5

*Stand-alone Tension Existed within Components of Both Classrooms*

<table>
<thead>
<tr>
<th>Segment (s) of Activity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension between nearby activity and central activity.</td>
<td>Some faculty members are not ready to use computers or apply technology into teaching. Consequently, students felt that they were forced to use tablets and DyKnow Vision in TPC.</td>
</tr>
<tr>
<td>Tension between nearby activity and central activity.</td>
<td>In some class at MIHL, students are not allowed to bring laptops to class. This was inconsistent with the objectives of the laptop initiative and rules of the institution. It might have an impact on TPC class.</td>
</tr>
</tbody>
</table>
Table 5

Stand-alone Tensions Existed within Components of Both Classrooms (continued)

<table>
<thead>
<tr>
<th>Segment (s) of Activity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension between the nearby activity and subject of the central activity.</td>
<td>Once in a while the instructor who teaches in a classroom before Dr. Pen was not timely in her dismissal of students. This inconvenienced Dr. Pen because she needed to set up her class on time. Dr. Pen would also worry about inconveniencing the next instructor by her own time to disconnect and pack up after class. (The passing periods are only 5 minutes between classes)</td>
</tr>
<tr>
<td>Tension between the subject and tool of mediation.</td>
<td>Students found out that batteries of their laptop computers die very quickly. This was thought to be a disadvantage to them since the warranty time was limited to four academic years. This also had an implication for their financial cost and learning outcome.</td>
</tr>
<tr>
<td>Tension between the subject and rules of the institution.</td>
<td>Students think the university should not block social media in the classroom because students regularly use it for academic meetings.</td>
</tr>
<tr>
<td>Tension within users (subject) and tools.</td>
<td>Instructors proposed to discontinue laptops and buy thin-client technology, but students want laptop computers with a bigger screen and better durability.</td>
</tr>
</tbody>
</table>

Tangled tensions that emerged in the laptop using class. Data from the classroom observation and field notes indicated some internal contradictions between learning technology and learning the main course objectives of TPC. Learning how to use tablets and DyKnow took time for students who wanted to learn Technical and Professional Communication. In the laptop using section, students were introduced to new tools. Dr. Tablet, the instructor of this class incorporated DyKnow and tablet PCs to achieve the goals and objectives of this course. The tablet PCs were different from laptop computers students purchased during their freshman year. The dialogue of January 11, 2010 between the researcher and two students, Mike and Ken, from the laptop using class indicated that it took too much effort to learn how to use Tablets and DyKnow software. For example, they reported frustration with a tiny tablet screen, clouded
keyboard, and awkwardness with the input pen (stylus). As an outcome of this challenge, it was very hard for them to accomplish the classroom activity that day which was to sketch diagrams.

During an interview of January 14, 2010, students from the laptop using class responded to the question regarding inconveniences of using laptops for learning. Sophie, a student from this group, commented, “We get behind with tablet PCs and DyKnow just because we are not familiar with them…I am getting familiar with my tablet when we are already heading to the third week of class.” Furthermore Scarlet from the same class explained how setup was a long procedure, “…In DyKnow, I need to put the computer on, to access the Internet, plug my tablet in, get my notes from DyKnow; this is a kind of a long process.” Then Mikeala stressed that she heard some students in other classes blaming Maple software as the problem of the failure or the cause of late assignments. Leopold, from the laptop using class, also added, “It would be logical to start with tablets PCs and DyKnow from freshman year so that everyone is just using tablet PCs instead of laptops.”

In the laptop using class, students also expressed some frustrations in using tablet PCs for note-taking. Mikaela (January 14, 2010) mentioned, “One of the inconveniences of a tablet is the lack of space on screen on one side; it is like you are using a third or a quarter of the computer screen. I just want to have a piece of paper to write on, you know.” Christy (January 14, 2010) added, “Again the stylus is so small, I cannot hold it very well. I prefer to have a pen or pencils to write with.”

The above dialogues reveal the tension between the learning technology (tool) and doing the activity under investigation. In return, this contradiction created an additional conflict between tool and the subject. Consequently, the tangled tensions may have created a heavy task
to infuse new technology into teaching (object). The tangled tensions are presented in the triangles of Figure 6.

Taking this scenario into a CHAT context, the aforementioned contradictions are what Barab et al. (2002) described as the primary tension, which usually arises between the use value and exchange value (refer to pages 8 and 9) for more explanation about tensions that emerge in every activity system. At the beginning of the quarter, learning technologies created difficulty for students who wanted to learn Technical and Professional Communication course materials. The above contradictions first emerged between learning technology and learning the intended course objectives. Furthermore, the same contradiction became more intricate and triggered sizable tensions within components of the activity system. All these tensions are summarized in Table 4.

**From primary tension to tangled tension.** To elaborate these tangled tensions, let us observe clearly the source of these contradictions. From the time MIHL started the laptop initiative, every student had an obligation to purchase a laptop computer during their freshman year. This is the same machine used as a primary device for classroom activities. On the contrary, students were introduced to another tool (tablet), different from their own laptop computers. In this case, the tension reappeared between the tool (laptop) for the activity under investigation and the subject (students and the instructor). This may have impeded student learning of the main course objectives of Technical and Professional Communication.

The frustration from the new tool may have influenced the subject to suggest a different type of device that differs from the tablet and laptop computers. For example, Dr. Tablet thinks that the institution should phase-out laptop computers as the primary device of classroom
instruction. She suggested moving toward thin-client or thin-computing technology. When she was asked to describe her experience in using laptops, Dr. Tablet commented,

…Students like laptop computers because they can play games on them. When we do a survey and talk about technology, they [students] want to spend their money on a big workstation; they can play “Halo” and any other games they can find on it. (Dr. Tablet, March 1, 2010)

The majority of the other participants expressed similar feelings as Dr. Tablet’s concerning the issue of moving from laptop computers to a newer or another teaching device. In response to the laptop experience, other participants in the focus group also shared the same reaction. Dr. Pen. (Dr. Pen, February 14, 2010) expressed that portable, thin, and light laptops will change the frequency of when she wants to use laptops. In other words, she will be willing to increase the amount of time of her laptop instruction. Students also noted that the laptop computers supplied by the institution were not convenient for an engineering application and other classes like Technical and Professional Communication. They want a device which is durable, thin, has a larger screen, keyboard, and is easy to carry around.

In a response to the question of the device type and technical support students wanted to get, Larry, a student from the non-laptop using classroom, clarified,

I mean, the laptop we have now, shouldn’t be absolute …but, having some sort of a new device, looks like NotePad, running through a Microsoft program, instead of carrying an engineering pad and paper with you, you can carry your laptop with you and have a scribble pad, that is electronic and as you take notes. You just stream in your computer, you have file and files. (Larry, February 18, 2010)
All of the above statements reveal that the subject (instructors and students) had justifications for phasing out the existing “tools” to acquire newer technology. At the time, subjects (students) had reason to justify the challenges of the object (learning technology).

**Method used to minimize tensions.** One of the important focal points of CHAT is to inform how the different components of the activity system mediate and transform the system under investigation (Engeström, 1987). With respect to the role of the subject, participants from the laptop using class pointed out how the instructor and students used innovative ways to transform the activity system. As has been mentioned in this study, it is essential to know the existence of internal tensions and contradictions that exist within the activity system (Kuuti, 1996, Engeström, 1987). This knowledge allows the subject and the community to understand the transformation and renovation of the activity under study. During the focus group interview of the laptop using classroom student of February 18, 2010, student Mikaela informed the researcher that Dr. Tablet’s motivation and expertise in using tablets and DyKnow transformed her frustration into an enjoyable learning experience. She also indicated that the combination of Dr. Tablet’s innovative pedagogy and collaborative projects helped members of her class to utilize the tool (laptop and software) appropriately. Ultimately, students realized that the use of technologies (tools) was actually useful and was a benefit to their learning.

These passages also show participants’ reactions when the researcher asked about the role of the instructor in using tablets or laptops in the classroom. Christy (February 18, 2010), a student from laptop using class said, “Actually Dr. Tablet’s class was fun and entertaining.” Her classmate Leopold explained how the classroom management was important to him. He stated, “We are well engaged because the professor manages the class very well…she is super entertaining!” Sophie also backed Leopold and expressed how the professor played an important
role, “We have to use tablets and we enjoy it… It was very interactive and the professor knows how to use it appropriately.” In return, Dr. Tablet was also convinced that her students were more engaged than ever. Her pedagogy helped students to enjoy the class.

Besides that, the class evaluation and feedback from previous students who used laptops for instruction support the case that the tablet and DyKnow instruction improved their learning. Dr. Tablet shared that the institution conducted a survey of 141 students from four engineering classes that used tablets and DyKnow software in classroom. They collected pre-course survey and post-course survey data to learn the level of comfort in using technology among students. The finding of this survey indicated that there was a statistically significant increase of confidence in using tablets and DyKnow, note taking, completing learning objective ($p < .05$).

(Personal communication, March 1, 2010)

**Tangled tensions that emerged within the non-laptop using class.** Similar challenges of using technologies occurred in the non-laptop using group. Students and instructor indicated that setting up technology took too much effort to accomplish tasks (object) within a session of 50-minutes. For example, Dr. Pen, the instructor of this class, reported a lot of multitasking had to be done in her class. She mentioned that connecting power on laptops, booting up, syncing the instructor’s laptop to the projector, and connecting her laptop to the Internet took a significant amount of her class time. However, the tension related to the use of a new tool for mediation was not observed or indicated by the students from the non-laptop using class because they did not use any new software or a new tool.

In this class, a different contradiction appeared between the old and new way of giving instruction. As indicated in the beginning of this chapter, the instructor of the non-laptop using class occasionally had students use laptops and at other times she preferred a traditional
classroom setting. During the interview of February 14, 2010, the instructor of the non-laptop using class, Dr. Pen, justified the need of blending both computer-mediated and traditional classroom instruction. The instructor indicated that the laptop was used on certain days for demonstrating some tasks that could not be achieved without a computer.

Contrary to the instructor’s statement, 50% of her students who participated in the focus group interview stated that they found it difficult to use the laptop and follow the professor at the same time. They further acknowledged that the laptop was just a distraction for this particular section. In this context, students from the non-laptop using class supported the traditional classroom-learning method. Data, a student from Dr. Pen’s class, justified the traditional learning method by saying,

Remember the study shows that you retained 10 to 15% information you hear and you retain around 15 to 20% of information you write, but when you hear and write at the same time you retain 75% of the information. (Data, February 18, 2010)

His classmate, Geoffrey (February 18, 2010) also added, “we need a tool we can use to access Maple or some classes where you can analyze math equations…otherwise, paper and pencils are better in this class [TPC].” Most students also from this class suggested that there was no link between using a laptop for learning and traditional classroom learning practices. Students from the non-laptop using class commented further. Geoffrey stated (February 18, 2010), “It would be easy to do class without the laptop anyway. I do not see it as necessary at all.” With another probing question the researcher asked, “What do you want to change in this class?” Favor, from the same class, responded,

I feel like everyone should keep all laptops closed at the beginning of the class and the professor can give an overview and pass around the hand out and goes around giving us
input, … Instead of seating down and listening to what the professor is talking about.

(Favor, February 18, 2010)

Putting this scenario under the CHAT framework, there was a contradiction between the old way of doing an activity and the new way of engaging in an activity system which created a tension known as tertiary tension (Yamagata-Lynch & Haudenschild, 2005). This condition may have encouraged students to resent the laptop initiative while they were required to change their learning methods. According to some student participants, sometimes they deviated from classroom activities to find entertainment on the Internet, which in the long run created a tension between subject and rules of the classroom. Consequently, the tension created another string of other contradictions as indicated in Table 4 and Figure 8.

From stand-alone tensions to nested tension. The aforementioned tensions originated between the old way of doing an activity and the new way of performing an activity. In addition, students from the non-laptop using classroom felt that the new way was not appropriate for their learning, and the tool of mediation (laptop) was not helping to accomplish classroom activities. This condition created a tension between the tool and subject; and further it triggered another tension between rules of the activity system and the subject. What made this tension even more complex is that students from the non-laptop using class did not pay attention to the classroom rules, particularly when they had a laptop with them. In short, participants from this section had a different attitude towards the classroom norms and regulations.

In connection to the question related to the non-classroom activities that distracted students, they admitted using unauthorized media in class. For example, during the interview of February 18, 2010, Henry commented, “Yes, when I am bored I can look for online activities, Facebook, and some interesting sites. Data responded, “Sometimes I use it to email people, even
friends who are around me.” Everyone [focus group from non-laptop using classroom] laughed. Then, the researcher added a probing question, “Do you use entertaining media in TPC class or in other classes, too?” “It depends on how interesting the class is, I guess.” Data replied. Finally, Beta said, “I try to pay attention most of the time anyway, otherwise I go to Facebook.”

Even though students were aware of classroom rules, some participants in the non-laptop using class admitted to using laptops for activities that were not related to the class. They played cards, went to Facebook, texted from their mobile phones, IM, sent emails to their friends, checked weather, and chatted with friends. Some participants also reported that their colleagues distracted them by watching social media on their laptops. The combination of classroom norms and institutional rules did not stop students from engaging in non-classroom activities. Figure 6 shows the relationship between the secondary and quaternary tensions. This illustration presents more detail associated with the representation of the larger schema found in Figure 8 in Chapter 5.
The contradictions illustrated in Figure 6 are complex and usually create unbalance within the main activity under investigation (Engeström, 1987). Therefore, as suggested in *Learning with Media* by Kozma (1991), media without the help of the organized pedagogy does not necessarily reflect the vehicle for cognitive and developmental learning. According to Throne (2003), blending teaching methodology needs to be in the context of what is happening in the global environment. Thus, the strategy of blending learning should not be done only in consideration just for training, but should be also done in consideration of the relevant instructional content.

To support Kozma’s (1991) argument, let us consider what the research found in the laptop using class. A total of 100% of the students who participated in the laptop using classroom and focus group interviews recognized that they enjoyed the Technical and Professional Communication class because Dr. Tablet was interactive, passionate, and enjoyable.
Nevertheless, they also reported that they would rather have a chance to use a pen and paper to record their own notes.

**Common tensions that emerged within both classrooms.** As indicated in Table 5, students from both laptop using and non-laptop using classrooms also specified some inconsistencies in using laptops on campus. There were some concerns that in some classes other than TPC, laptops were not allowed in class. When students brought a laptop to class, those professors thought that students were playing around with the Internet. Usually, when such incident occurred, the same professors ordered students to shut the laptop down. By denying students the right to use the laptops in the classroom, those instructors were contradicting the motive of purchasing laptops.

Even though this tension emerged within the rule of the institution, it may have had an influence on the subject of the activity system (student in TPC) under investigation. Succinctly, Dr. Tablet (January 18, 2010) informed the researcher that students in her class sometimes asked why they use tablets and DyKnow when it is not a class for engineering, mathematics, or computer science. Similar observations were shared by two participants in the non-laptop using classroom. Geoffrey (February 18, 2010) from the non-laptop classroom confirmed, “Some teachers have rules to bring laptops in classroom…like when you are using Maple or Math Lab classes, otherwise if you bring it, they think that you are messing with the Internet like we do anyway.” Beta (February 18, 2010) said that his class of Communication and Professional Development does the same thing. He asserted,

In Technology Communication class [the non-laptop using classroom], we are allowed to use it for particular day, like when she wants to show us something…there is a time she wants us to use them, like when she wants to use a visual aid (Larry, February 18, 2010)
All of the above declarations show the contradiction and inconsistencies that appeared in the activity system. According to the CHAT model, the contradiction that appears between the nearby activity and the central activity is known as quaternary tension.

As the researcher continued the analysis, the different conflicts between components of laptop activities became evident. First, participants complained about the longevity of batteries in their laptop computers. Even though there are a sufficient number of power outlets in every classroom to keep the battery charged, batteries did not stay charged long; and usually students did not realize that the battery was getting weaker. Second, there was also a general concern about the cost of their laptop and software. Students who participated in focus group interviews were convinced that it was not cost effective to buy the laptop computer with the institution’s package deal. The combination of these tensions reflected on tuition and may have been one of the reasons why students did not like this particular brand of laptop.

**Suggested method of doing activity system.** One of the main powerful features of the CHAT model is that it reveals methods of remediation or transformation of tensions that appear within the activity system. In the non-laptop using class, students came up with different suggestions of doing activities or solving the conflict that existed under the activity system. They proposed that the institution extends the battery warranty period from 4 to 5 years and to be inclusive of their date of graduation. They also wished that docking stations were installed in every classroom. They thought that these suggestions would increase the life of batteries and would save more time for classroom set up.

In response to the question related to the main challenges of using laptops and tablets, participants from the non-laptop using classroom expressed different opinions. Favor commented,
...Every classroom need to have docking stations because the batteries of our laptops die very quickly... by the time you reach your junior year, your battery charges from 20 hours to 20 minutes or possibly does not work at all. (Favor, February 18, 2008).

When the researcher asked whether classrooms were equipped with enough electrical outlets, Beta from the same classroom carefully responded,

We do, it is just because our batteries die so fast...we need a kind of a new battery replacement policy, like a warranty or maybe a new battery at every junior year...a lot of time freshmen do not realize how their battery is going to get bad in few months and by the time they realize it, it is too late. (Beta, February 18, 2008)

And then, Data, a member of the same group reacted on institutional policy, “Right now, we have warranty for only one year, after one year they [institutional policymakers] do not replace it, no matter what!” This conflict describes the tension between the subject and tool of mediation. Under the CHAT framework, this contradiction is known as secondary tension.

Another example of the secondary tension was observed between users and class norms (formal rules). Participants in the laptop using class were always tempted to use unauthorized social media in the classroom. However, Dr. Tablet’s students did not risk using social media in her classroom or breaking instruction stated in the syllabus because they feared facing the negative consequences of failing the class or being suspended from the institution. This conflict revealed the tension between the subject (students) and rules of the laptop-activity system.

In the long run; however, students thought that it was worth it to watch Internet media because they were well engaged. When students in the laptop using classroom were asked to explain some rules related to the classrooms, Christy (January 15, 2010), a student in Dr. Tablet’s class suggested some resolutions related to this tension, “Actually the most tempting
activity is email, but I am afraid of Internet sniffers… but this class is engaging, otherwise in other classes we chat and go on Facebook,” In return, Sophie (January 15, 2010), her classmate added, “Sometime we can read news, Google, and check email, but this class is more engaging and we like our professor [Dr. Tablet].” These statements clearly reveal that the instructor played an instrumental role in making instruction more appealing and interactive.

The researcher was intrigued to find out if there were really some web sniffers or whether the institution blocked the Internet media. He asked the question, “Are you really convinced that the university uses web sniffers to monitor students who actually use social media in class?” Sophie (January 15, 2010) replied, “I do not know if there are any other programs she [Dr. Tablet] can use to figure it out, but I know she can use DyKnow to know if you are using it [Internet media].” The whole group was convinced that there exist programs to reveal what students were accessing on the web. This knowledge made students even more fearful. Christy used an example of how her high school used to monitor the library activities. She explained,

We had one in my high school…if you are in the library, trying to play games in the Internet or surfing the Internet, you could see all suddenly a kind of red screen and you hear a voice telling you to come to circulation …I know there are programs there they can use…anyway I fear, I do not want to get into trouble…I just focus on slides and keep going. (Christy, January 15, 2010)

Common method for enhancing rules in both class sections. Although the two instructors had different teaching methodologies, they both shared common views for enhancing classroom rules, norms, and values that were most helpful for classroom management. During the second group interview, the researcher asked the instructors to explain the type of rules for the use of laptops for instruction. Dr. Tablet (March 1, 2010), the instructor from the laptop using
class replied, “…There is a direct correlation between the student who spends time in my class playing computer games and the grade they get.” To remind readers, participants previously expressed that they feared to watch social media and thought that Internet media was blocked or not allowed. This instructor comment explained the reason why students feared to engage in unauthorized social activities during her class. It also explained the tension that existed between subject (students) and the classroom rules (no social media during class).

The instructor of the non-laptop using class, Dr. Pen also responded,

I have a policy that students can only use the laptop for course related activities. If they use it for everything like checking email, or going on Facebook, it is considered as a violation of the class policy. Sometimes I can work near them and stand behind them so that it is apparent that I am looking at their computer screen, most students will understand and change what they are doing…Occasionally if a student does not take a hint, I say explicitly please do not do email now. After making that kind of point once or twice, I never have a student who keeps doing it after that. (Dr. Pen, January 15, 2010)

Although the instructor used these methods to reinforce classroom rules, some students in the non-laptop using class knew how to break the rules of this class without being discovered. When the researcher asked students the types of distractions related to the laptop-activity system, Geoffrey (February 18, 2010) from Dr. Pen’s class revealed the way he broke rules without being caught, “I open up many windows tabs for email, one for Facebook, and others for class…and when a professor walks toward me; I can very quickly minimize them.” Another example that justified this behavior happened during classroom observation on January 4, 2010 at 11:17 a.m. Ken was busy texting in his cell phone and was not paying attention to what the professor was doing. This evidence reveals the complexity of the nested tensions.
Participants in the focus group also added that some faculty members and students are still committed to traditional pedagogy. There are still a few faculty members who do not make an effort to learn or encourage students to use laptops. In this study, for example, Dr. Tablet (March 1, 2010) explained some reluctant behavior related to the use of laptops. She stated, “A number of faculty and students own laptops or have access to all engineering software in the computer network…but they do not make an effort to use them.”

Dr. Tablet further mentioned that students in her class wondered why they were forced to use laptops in the TPC class when other professors did not require them in their classes. Her statements indicated that participants of the central activity were influenced by the subject of the object motive of the nearby activity (other professors and other peers from the same institution). In another words, faculty members and students from other classes may have influenced the members of the Technology and Professional Communication course. According to Barb et al. (2002), when the contradictions arise between the object motive of the activity system under investigation and the object motive of the nearby activity, it is called tertiary tension.

Later, the researcher wanted to know whether there was any help instructors needed to better incorporate the laptop into teaching or if they are willing to share technical skills with other faculty members. Dr. Tablet (January 18, 2010) responded, “I am willing to share knowledge about laptop usage with those who are willing to learn.” But Scarlet, a student in the laptop using class responded differently when the researcher asked if there was computer training available for faculty members and students. Scarlet (January 15, 2010) responded, “Even if everyone is trained to use it, some people will find an excuse not to use it; some will say that they are too old to use it.”
During classroom observations, the researcher finally noticed another tertiary tension between the central activity (non-laptop using class) and the nearby activity. The instructor who taught a class (the room where non-laptop using was meeting) was always late to dismiss her class. This circumstance created difficulties for Dr. Pen’s class who always wanted to setup her class on time. This experience was a source of inconvenience and disturbance to the subject (Dr. Pen and her students) of the central activity. Consequently, Dr. Pen was always forced to speed up so that her class could catch up with the time lost in the process.

Summary of Activities

The findings from this qualitative inquiry show that Cultural Historical Activity Theory provided the opportunity to clearly understand the structural relationship between components that composed laptop usage in two classes of Technical and Professional Communication at the Midwest institution of higher learning. CHAT also facilitated the interpretation and analysis of contradictions and tensions that existed within laptop instruction. Though the researcher presented a number of tensions, the results show that most of tensions did not present a future threat to the laptop-learning activities. The majority of tensions were resolved due to the effort of the subjects (instructors and students). The summary of both intricate tensions and stand-alone tensions is depicted in Figure 7, Figure 8, Figure 9, Table 3, Table 4, and Table 5.

Besides the analysis of tensions, evidence from the data analysis indicates that implementation of this institution’s laptop initiative has had a positive impact on students in several areas. Data from instructor interviews, classroom observations, and focus group interviews reveals that students in both classes used laptops to access Internet information, to collaborate, for peer review, and as preferred communication. Likewise, instructors used laptops to enhance inquiry-based learning and problem solving in several departments of the institution.
Additionally, the instructor of the laptop using class reported some advantages related to the decreased expense in maintaining computers on campus. Since every student needs to purchase a laptop during their freshman year, the institution reduced the number of computer labs it operates on campus. Thus, the institution is no longer spending significant dollars to support five computer labs as before the initiative. Moreover, the laptop maintenance requires less funding because all laptops have the same hardware and software. In relation to laptop maintenance, technical support is provided “in house” by knowledgeable staff, and occasionally by students majoring in computer science.

The instructors also reported an increase in the enrollment of professional development activities that are aimed to assist the faculty members in integrating laptops into their classroom. Both Dr. Pen and Dr. Tablet affirmed that the majority of instructors team up and inform each other of the new developments related to tools needed to successfully integrate technology-based systems into learning. Professional development is usually accomplished through conference presentations, campus training, and publications.

Furthermore, the data interpretation reveals that the laptop using class was more successful in integrating the laptop and software into learning. Even though students and the instructor of this section reported having challenges at the beginning of the semester, the results show that after a few weeks students became familiar with DyKnow and tablets. As the result of the usage of tablets, students became engaged and achieved several activities that could not be accomplished without technology-based instruction. One factor which contributed to such success was the motivation and interest from the instructor who has been involved with the laptop initiative since 1994, when the institution decided to implement the laptop program. Another factor in the success is related to the overall class management. Students in the laptop
using section complimented Dr. Tablet’s management style which is usually one of the major challenges for a laptop class environment.

On the other hand, the findings indicate that the non-laptop using class presented mixed results. Students and the instructor of this section reported that the laptop was beneficial for communication with peers, Internet activities, peer-review activities, and project presentations. Additionally, the instructor of this section also commented that her use of the laptop was much better than previous quarters. A few barriers, however, have been identified in this class. A first obstacle related to the way the tool was used to achieve the object of the activity under investigation. The qualitative data analysis revealed that some students in the non-laptop using class felt that the use of a laptop was not relevant to their learning. A second barrier discovered was connected to classroom distractions. Students admitted using the laptop for social activities and, in fact, had a hard time shutting down their social media during class time. The instructor of this section expressed concerns about the distractions related to the laptop and Internet. For example, Dr. Pen commented that the laptop obstructed her view and that she could not have direct eye contact with her students. The third and last obstacle was the disturbance from a different class that met before her class. Dr. Pen raised concern about the professor who was always late to dismiss her class. This delayed Dr. Pen’s class set up. All these obstructions hindered, in one way or another, the use of the laptop for teaching and learning in the non-laptop using class.

Since Dr. Pen did not utilize laptop instruction to the degree and depth as Dr. Tablet, it is understandable that student “take away” would not be the same. One factor that may have contrasted the classroom instruction is the ease and background of each instructor. Another factor may have been the level of integration which the instructor used the laptop. Students
themselves and the community they formed within the classroom were also an influential variable in this comparison. Also, different devices and software used may have impacted the overall enthusiasm and learning outcome.
CHAPTER 5

Discussion, Recommendations, and Summary

This study investigated the differential impact of a laptop initiative in two classrooms of TPC at Midwest Institution of Higher Learning. The study focused mainly on two classrooms of Technical and Professional Communication in order to collect relevant data related to engineering student experiences in a laptop computing setting. The research consisted of classroom observation and group interviews about how students used laptops for learning and how two instructors used it for instruction. Specifically, the investigation used Cultural Historical Activity Theory as tool to collect evidence that explained the differential impact of laptop instruction, the justification for using laptops in the classroom, the benefits, disadvantages, and the reason behind the reluctance to applying laptops for instruction.

To obtain rich and informative data, 12-student volunteers and two instructors were selected from a laptop using and non-laptop using classroom for focus group interviews. In addition, the researcher conducted 22 classroom observations per class. All interviews and classroom observations went on successfully and all respondents were eager to engage in a discussion with the researcher.

Even though, to some extent, students had similar types of classroom activities, there was a big gap between laptop usage in the laptop using and non-laptop using classrooms. Participants
of the two sections showed different feelings toward laptop instruction and their responses were a great asset for this research. Findings revealed that participants in the laptop using classroom showed higher interest in using laptops and software for learning than those in the non-laptop using classroom. These discrepancies might be attributed to the fact that both classes used different type of machines, software, and different instructors’ pedagogy. As indicated previously, Dr. Pen emphasized teaching with traditional classroom methods and having students use a laptop for special purposes on particular days. In contrast, Dr. Tablet not only used the tablet, she also used DyKnow software and digital ink for every class activity.

Data from classroom observation and focus group interviews suggested that participants from the laptop using classroom appeared more enthusiastic about having a laptop for classroom activities than students in the non-laptop using classroom. In the laptop using classroom, students reported that having tablets and DyKnow software facilitated learning TPC course objectives and increased students’ chances to learn new things that will be beneficial as they progress towards advanced class designs and future careers.

Previous studies are consistent with the aforementioned finding. For example, Kozma (1991) pointed out that learners find more interest in using media for learning when the teacher applies them more frequently in class to illustrate his or her teaching. Additionally, limited access to computer resources has been reported to be another contributing factor which impacts interest in using computers for learning (Cuban, 2001; Penuel, 2006). These same researchers, Cuban and Penuel, argue that providing students with mobile computers loaded with different application software can provide students with learning opportunity.

Participants were convinced that the collaborative activities increased their motivation to learn the intended class objectives and encouraged them to be better communicators. Likewise,
the literature in the area of the laptop initiatives has demonstrated higher achievement levels for students who engage in collaborative learning than those who complete individual work (Windschitl & Sahl, 2002). Although both Dr. Tablet’s and Dr. Pen’s classrooms both used collaborative activities, the collaboration facilitated by the laptop in Dr. Tablet’s room led to students’ increased sense of efficacy.

In the same perspective, Windschitl and Sahl (2002) found a positive outcome for teachers who use Internet resources and different application software as a source of student-learning materials or computer-based pedagogy than those educators who deny the existence of enough teaching material for computer-based learning. Referring to Dr. Tablet’s classroom, the use of tablet PCs loaded with DyKnow Vision, Angel Learning Management System, PowerPoint, and Microsoft OneNote facilitated group collaboration, communication with peers and instructors, and fostered student-centered learning and problem solving. In fact, the activities observed in the laptop using classroom mirror the results from recent studies. For example, recent investigations found that using laptops with different software and the wireless Internet connection increased the use of note taking, Internet searching, sharing communication skills, collaboration, and peer review (Hill & Reeves, 2004; Roschelle et al., 2004). Warschauer (2006, 2007) and Zucker and MGhee (2005) found that using laptops increased students’ ability to manage class notes, increased student research skills, enhanced group presentations, and supported online communication. Windschitl and Sahl’s research also showed that the knowledgeable instructor who had a greater interest in using laptop instruction afforded students a more innovative learning experience.

Overall, participants in the laptop using section indicated that the laptop initiative contributed positively to their learning and it was worth using. They specified that it took a while
to gain familiarity with using the tablet and DyKnow. However, the classroom observations showed that this challenge did not last for a long period of the time. After two weeks of classes, students started picking up DyKnow applications and were able to familiarize themselves with tablets and successfully accomplished all assignments provided in this course. Thus, student responses suggest that future sessions of this class may need to dedicate time for familiarizing students with the use of DyKnow software. According to participants, instructors also need to increase awareness and reinforce rules to prevent students from using unauthorized activities during classes.

Compared to the laptop using classroom, findings from the non-laptop using classroom also indicated that the use of the laptop allowed the instructor and students to create continuous communication and share information after class. According to data collected from classroom observation and focus group interviews, the communication was important for requesting project feedback, or tackling problems relevant to the group assignments. One of the important tasks of this nature was when a group of students was assigned a project in which they were expected to keep in communication while searching information regarding the project of a poster presentation at the end of the quarter. Similar findings were revealed in Chambers et al. (2006). In the Chambers et al. study, student-student communication and professor-student communication was enhanced in a laptop using classroom.

However, student from the non-laptop using classroom often expressed frustration toward the use of the laptop for classroom activities. According to the students from the non-laptop using section, the Internet and other social media posed serious distractions. Some participants in the focus group, particularly students in the non-laptop using class admitted using a laptop for recreational activities when the instructor was teaching or when other class members
were busy with class activities. For example, when the researcher asked students to describe the kinds of distractions related to the use of laptop, students indicated using the laptop for a number of unauthorized activities during class.

The instructor of the non-laptop using section, Dr. Pen, was not totally in favor of using laptop instruction, especially during the first interview. The instructor admitted that the laptop had potential distractions to slow down the learning process. Her statement is echoed by educators from different institutions of higher learning across the nation who banned laptops in their classes as a consequence of Internet distractions or other social media (Young, 2006). Dr. Pen’s feeling is understandable especially when the instructor is not proficient with the laptop or not prepared to integrate the laptop into teaching and learning (Weaver & Nilson, 2005). However, during the second interview, her statement modified somewhat. She voiced a commitment to getting more training with computer software and utilizing more technology in future classes. Her statements reveals why she preferred using laptops on certain days or to minimize the use of it altogether.

In general, students from the non-laptop using and laptop using classrooms did not automatically show that the laptop was a preferred method for note taking. Specifically, all students who participated in this study unanimously commented that they preferred using paper and pencil to write their own notes. Similarly, researchers have described note taking as one of the most challenging aspect for tablet-based instruction. Chambers et al., (2006) conducted a survey in seven courses of engineering, humanities, and science at Rose-Hulman Institute of Technology to find out the usefulness and the impact of using the tablet PC and DyKnow software for communication and learning. The study involved around 20% of students of the entire institution. Half of all participants responded that tablet PCs were useful in term of
collaboration, ease of following the professor, and communication. However, most students indicated that it is very difficult to take notes using a congested keyboard and a tiny screen.

The cost for technology was also mentioned as a major laptop impact reported in both classrooms. Even though related literature reported financial difficulties linked to laptop cost in different institutions that adopted laptop programs (Georgia system ends laptop program with debt and claims of success, 2001; Warschauer, 2006, 2007), this study revealed opposite results at MIHL. During data collection, participants reported that an important impact of the laptop initiative was the decrease in cost of computer maintenance for this institution. In addition, the laptop initiative contributed considerably to improved technical support and transformation. Since students started carrying their own laptops, troubleshooting and servicing laptop computers are no longer a heavy burden to the institution because all laptop computers share the same software and hardware. This has helped technical support personnel in providing a better quality of service to instructors and students who are involved in the laptop initiative. Yet, “the financial burden for paying all these innovations was shifted from the institution to students and sponsors who pay this amount of money,” said Dr. Tablet.

Another impact of the laptop initiative, professional development, relates to the results found in previous research. A study conducted by Dawson et al. (2008) regarding the Florida Enhancing Education Through Technology initiative showed that the integration of professional development and laptop implementation increased computer-based teaching, meaningful learning activities, and collaboration among faculty members. Weaver and Nilson (2005) asserted that a well-designed laptop faculty development program was one of critical factors that influenced positively the laptop implementation at Clemson University.
The qualitative data collected in this study revealed that students’ learning experiences benefited from the thoughtful integration of the laptop into instruction as was found in the Dawson study. Additionally, there was a perception on the part of the participants in this study that the professional development opportunities that were being offered at MIHL would lead to enhanced learning experiences for students. Moreover, this study found that collaboration on campus was already enhanced and that faculty was engaged in peer mentoring as part of the professional development activities. Since the laptop initiative started at this institution, this study found that the institution has stepped up the initiative to provide enough resources to allow faculty members to enhance their abilities to thoughtfully integrate laptops in instruction. The office of institutional research, planning, and assessment is committed to increase monetary funds that will allow faculty members to upgrade teaching materials such DyKnow and laptop applications. In addition, the same office is committed to encouraging instructors to share teaching resources; and is also willing to provide training for faculty in the area of laptop technology, and in using DyKnow and tablets, specifically. More to that, several faculty members from different departments at MIHL have created a collaborative partnership that allows them to share resources and learn from each other about how to effectively incorporate technology into teaching.

**Cultural Historical Activity Theory Interpretation and Analysis**

The interpretation of data from the CHAT framework revealed different tensions that occurred within or between different components of the activity system. Figure 7 summarizes the relationship between tensions that emerged in the laptop using class, and Figure 8 shows tensions that existed in the non-laptop using class of TTPC classes during the winter term. As represented
in these figures, there are some tensions that appeared repeatedly and created intricate interactions within components of the laptop activity system.

Figure 7. The laptop using class activity system. The figure illustrates tensions that emerged within components of the activity system.
However, the tensions which were not severe or did not present any disturbance in laptop activity system were not presented on the Figure 7 and Figure 8, but all of them are included in Table 3, Table 4, and Table 5 and some may have been solved by the subjects (students and instructors) before the end of quarter. Figure 8 and Figure 9 illustrates unsolved tensions. In addition, the presence of these tensions revealed that most components of the activity system were not static, but dynamic, which is a very important aspect of a successful activity system (Kuuti, 1996).

As indicated in Table 3, Table 4 and Table 5, CHAT analysis identified two major categories of tensions in each classroom. The first group consists of tangled tensions and is illustrated in Table 3 and 4. In this research, these tensions are called tangled because of their nature of being interconnected; meaning that the existence of one created one or two more tensions. The second group of tensions is labeled as stand-alone tensions and is presented in Table 5. These tensions emerged within two nodes of different elements of the activity system.

The first tension emerged in the laptop using class. Learning how to use technology conflicted with learning the intended course materials in TPC. This tension is represented by with a red line in Figure 7. Responses from participants in the laptop using section suggested that learning how to use DyKnow software conflicted with learning the intended course materials. The same tension became tangled when students mentioned that they had difficulties dealing with a tiny tablet screen, clouded keyboard, and input pen (stylus) of the new tool (tablet). This tension is represented by a violet line in Figure 7 and more explanations are presented in Table 3. To illustrate how the tension affected learning, participants reported, for example, that it was challenging for them to use a stylus to sketch sophisticated graphics. Consequently, students said that they prefer using pen and paper for taking notes instead of using tablets for note taking.
However, students supported the instructor’s use of the projector screen, tablet, and DyKnow software to enhance learning.

Figure 8. The non-laptop using class activity system. The figure illustrates tensions that emerged within components of the activity system.
A contradiction, similar to one in the laptop using classroom emerged in the non-laptop using class and is presented as a red line in Figure 8. As summarized in Table 4, technology set up took a long time in the non-laptop using section. As a result, class members had challenges to accomplish activities within 50-minutes. In response to the question related to the barriers related to the use of laptops, the following reactions emerged among participants from the non-laptop using class. Dr. Pen commented,

What has been difficult for me is to do that quick set up...So, I think it became easier if the computer would boot up faster than they are used to...Set up the projector, getting the computer connected to the internet...It is getting easier time after time, but I want to see it become easier yet. (Dr. Pen, February 14, 2010)

In connection to tension between the subject (Instructor) and the tool for mediation (laptop), Dr. Pen also explained how the laptop was a good tool for certain activities, but also a source of distraction. For the question related to the inconveniences of using the laptop in class, she noted,

…What changed my mind, really, was complaints from students on the course evaluation that they were distracted by other students. They have a student near them who was playing videos and going to Facebook on computer. They found it very distractive. So they wanted me to police them (Dr. Pen, February 14, 2010).

In addition, her students also felt that they spent too much time following the instructor with laptops. They wished to spend some time in solving some activities rather than using it for following the instructor. When the researchers asked why the laptop was distracting from classroom activities, Beta, a student from non-laptop using reacted,
We are supposed to have a laptop to follow along with her; so she can stop using the projector screen. But I have not noticed anyone really following along with her because it is easy to follow along on the projector. With the projector, you can see where her mouse is, and where she is writing certain things. (Beta, February 18, 2010)

The above reactions suggest the tension between the way the subject used the tool and learning the intended course content. This tension is known as primary tension. As illustrated on Figure 8, the above tension created an additional tension represented as a black color line on the same figure. To be more specific, when students did not want to follow the instructor on their laptops, they opted to surf the Internet, went to Facebook, watched movies, and received and sent text messages from their cell phones.

During classroom observation, Ron, the student who was seated in the front right section of the classroom was busy texting on his cell phone. In addition, when students were asked to explain the type of distractions that were found in class, Henry from the non-laptop using classroom said, “Something like going online.” Data from the same group also added more distractions, Facebook, the weather, sending email to people, and IM. These comments revealed the tension between nearby activity and central activity. Further, results show that tensions become more complex because some students ignored the rule of the classroom and used non-classroom activities instead. Furthermore, these students who used social media created a disturbance for their peers.

Table 5 and Figure 9 show that there were additional stand-alone tensions that originated outside of the main activity system, and finally appeared within or between different nodes of the central activity system. In fact, most of these tensions illustrated in Table 5 were present in both laptop using and non-laptop using classes. For example, students in the laptop using classroom
expressed concerns of using tablets and DyKnow in TPC while other instructors did not use it in other classes. Students may have seen this move as forcing them to use tools that were not applied in some other classes. This tension originated from the nearby activity and ended up influencing the component interactions in the activity system under investigation. The contradiction might also have been a source of conflict that emerged between subject (students and instructor) and rules in both laptop using and non-laptop using classes. Precisely, students may have not wanted to use the laptop for note taking as they indicated their preference to use paper and pencil. The tension may have also influenced students who found that the laptop was not useful in a non-laptop using class.

Three more stand-alone tensions in Table 5 emerged within nearby activity system and ended up in the activity under investigation. For example, the teaching activity that occurred in a session before Dr. Pen’s class affected her technical set up of Technical and Professional Communication. Also, participants in the focus group reported that some faculty members who teach other classes did not allow students to bring laptops to class. This was inconsistent with objectives of the laptop initiative and rules of the institution. Students may have also used this conflict as a pretext to use laptop computers for unauthorized activities. Young (2006) documented similar incidents where professor banned laptop computers or restrained online materials. In his article, professors from different institutions indicated that they are no longer allowing students to bring laptops to their classes. Most of those educators indicated that the Internet, instant messenger, email, and online cheating among other distractions were some of the reasons for prohibiting laptops in classrooms. Such inconsistencies might have an impact on learning for the TPC course in both non-laptop using and laptop using.
Besides the barriers reported previously, Table 5 and Figure 9 also show some contradictions between tool and subject. Typical concerns related to batteries, wireless connectivity, laptop portability, data loss, and lack of proper infrastructure are frequently reported in other computer-based environments (Dunleavy et al., 2007; Efaw et al., 2004; Lowther et al., 2003). In this investigation, however, subjects (students) raised concerns about the longevity of their devices. The batteries of their laptops computers remained a challenge because they do not last for a long time. As a way to solve this problem, students suggested that the institution increases the warranty time until the student graduates from this institution. This was seen to be a serious conflict because it not only impacted on their financial costs, but also their learning outcomes.
Figure 9. Illustrates stand-alone tensions in both activity systems.
Recommendations and Implications

Using CHAT analysis allowed the researcher to determine the imminent tensions that might be threats to the laptop initiative in both Technical Professional Communication and the whole institution, in general. It is crucial that every educator and academic administrator understands the tension type that affects academic activities and how every tension relates to each of the components of the activity system. Tensions and contradictions discovered in this activity system (laptop activity) will allow the institutions, policymakers, and educators to address issues related to laptop policies. It will also give them insight into how to transform or restructure their laptop initiative. According to Barab et al. (2002), knowing the existing tensions will help prevent the damaging conflicts that can occur between different elements of the activity system.

Based on findings from data collected and the existing literature, some suggestions are provided to those educators interested or engaged in laptop instruction. The recommendations given here are based on the participants’ experiences and data gathered from classroom observations.

- Based on focus group interviews and literature cited in study, there is some reluctant behavior and unwillingness to integrate technology into teaching. In response to such comments, faculty should be willing to change their existing teaching methods and comfort zone to accommodate new innovation in the area of laptop instruction. For example, during second interview Dr. Tablet (March 1, 201) pointed out that some professor at this institution do not make effort to incorporate computer instruction into teaching, meaning that they are still using traditional classroom teaching. According to Cuban (2001) educators’ resistance to using technology is attributed to technological and
educational reform that happened previously. Cuban believes that the same memories still influencing the mind of some teachers. In this statement, Cuban is referring to the failure that happened few decades ago when television and film were introduced in education for innovation.

- Based on classroom observations and interviews, the researcher noticed that not all lessons and classroom activities necessarily meet best-practice criteria for effective laptop pedagogy. In order to create effective learning environments, instructors need to dedicate time to prepare relevant activities that work best for laptop usage in the classroom environment.

- The results of the data analysis also signaled that preventive measures are needed to curtail students using unauthorized activities during classes. It also suggests that allowing students to use laptops for certain activities might have been a source of confusion that students found frustrating. Previous investigations on laptop initiatives raised similar concerns. Most of them highlighted that the laptop classroom commonly presents different challenges such as classroom management problems, barriers related to Internet surfing and cheating (Hill et al., 2002; Newhouse 2001; Weaver & Nilson, 2005; Young, 2006; Zucker & McGhee, 2005).

- In addition to lessons learned from this study, the literature indicates that laptop using institutions should put emphasis on faculty training and put a high priority on the professional growth of every faculty member involved in laptop teaching (Broskoske & Harvey, 2000; Zucker & McGhee, 2005).
From evidence taken through classroom observations and interviews, the combination of an innovative instructor and well-structured pedagogy would inspire students to use laptops for collaborative and meaningful learning.

According to the student’s point of view, it took almost two weeks of class to familiarize with Dyknow software. For this reason, students from the laptop using classroom suggested that instructors of TPC should revisit the objectives that mandate both classes to use the same tools such as DyKnow software and tablets. For example Mikaela (January 15, 2010), a student from the laptop using class suggested that instructors should inform students concerning the type of tools they are expected to use before registering for the TPC class. This would allow students to be prepared psychologically to integrate the laptop into their learning.

According to the evidence gained from this study, professional development, technical support, and instructor training are very important factors that encourage faculty members who intend to incorporate laptop or computer-based instruction into teaching. Thus, faculty members need support and encouragement from the academic administration to successfully incorporate laptops into teaching (Dunleavy et al., 2007, p. 450).

Participants from the laptop using classroom and previous survey data of students who used laptop and tablet instruction at the institution indicate that collaborative activities are a very essential tool for laptop activities, particularly when the instructor uses interactive software like DyKnow.

Instructors and students alike proposed to discontinue laptop computers as a primary classroom device. Instructors suggested getting thin-client technology, capable of
accessing data from the network in a fast fashion, and they are light, and portable. For students, they want to have laptop computers they can use like an engineering pad, with a bigger screen, lightweight, and durable. Therefore, the student and faculty views are compatible.

- Students also suggested that the institution increase the laptop and battery warranty to their graduation date. For solving problems related to power and batteries, students also suggested docking stations for laptops to be installed in every classroom. Docking stations will not only save the life of batteries, but will also speed up the time for classroom set up. In return, it will also solve the problem of time being wasted connecting and disconnecting laptops.

**Future Research**

Although this research was not intended to learn the relationship between dropout rates and laptop instruction, the researcher is convinced that another study is needed to evaluate the impact of laptop instruction on student retention or student dropout rates and the role of laptop program on student enrollment. One important consideration of such research would be to attempt to learn the comparison between the student retention rate before the implementation of laptop program and after.

Since this study was limited to two general education classes, a different investigation is needed to answer in-depth questions related to laptop usage in a wide range of engineering courses at this institution. Additionally, it is important to conduct future investigations to find the correlation between the academic achievements gained by students from a laptop using classroom versus those who did not use their laptops daily. Importantly, future research is
required to track students in their advanced engineering classes or in their graduate-level work to determine the impact of laptop usage for learning.

Future study should include a larger sample of instructors and students involved in laptop activities. This study may help determine if students who used laptops for learning find benefits in their future careers. Such studies may include qualitative or mixed-method studies.

Finally, if more studies similar to this were done, institutions of higher learning might have data by which to determine the validity of having students make laptop purchases at a time when everyone is watching their budget.

Summary

The laptop initiative is a very important step toward the increase of computer knowledge, communication skills, and applications for solving various academic activities. The data collected in this study reveals positive impacts on students’ learning and instructors’ teaching experiences like Internet searching, peer review, team collaboration, communication, note taking, and social activities. In addition, qualitative data indicates that students from the laptop using class were more interested in using laptops for classroom activities than students in the non-laptop using classroom. As this investigation reveals, the combination of a motivated and experienced instructor, and collaborative learning activities contributed meaningful learning.

However, the findings also show some problems related to social media and classroom management. At the same time, Cultural Historical Activity Theory data interpretation and analysis was used to discover some inner tensions that emerged in both laptop using and non-laptop using and to provide a potential solution. As indicated on Figure 7, Figure 8, and Figure 9, some tensions were solved by the subject (students and instructors) and other need to be corrected in future.
Finally, future study is needed to answer in-depth questions related to laptop usage in a wide range of engineering courses at this institution. It is also recommended that future investigation be conducted to find the correlation between the academic achievements gained by students from a laptop using classrooms versus those who from non-laptop using classrooms.
References


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APPENDIX A: EXAMPLE OF THE LITERATURE MATRIX

<table>
<thead>
<tr>
<th>Source</th>
<th>Source and Key Word</th>
<th>Methodology</th>
<th>Research Design</th>
<th>Research Focus</th>
<th>Sample Population</th>
<th>Study Context</th>
</tr>
</thead>
</table>

Note: The table above provides a summary of studies examining the relationship between laptop use and academic performance. The studies vary in design, methodology, and sample population, but all focus on the impact of laptop use on student performance.
APPENDIX B: SCHEDULE FOR CLASSROOM OBSERVATIONS 
AND INTERVIEWS

*Time Line for Classroom Observations, Group Interviews, and Target Weeks for Completion*

<table>
<thead>
<tr>
<th>Task</th>
<th>Projected Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruitment of participants and informed consent</td>
<td>Week 1</td>
</tr>
<tr>
<td>The first focus group interview</td>
<td>Week 2</td>
</tr>
<tr>
<td>Class observation in every class meeting</td>
<td>Week 3</td>
</tr>
<tr>
<td>Class observation in every class meeting</td>
<td>Week 4</td>
</tr>
<tr>
<td>Class observation in every class meeting</td>
<td>Week 5</td>
</tr>
<tr>
<td>Class observation in every class meeting</td>
<td>Week 6</td>
</tr>
<tr>
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<td>Week 7</td>
</tr>
<tr>
<td>Class observation in every class meeting</td>
<td>Week 8</td>
</tr>
<tr>
<td>Class observation in every class meeting</td>
<td>Week 9</td>
</tr>
<tr>
<td>Last class meeting and the last focus group interview</td>
<td>Week 10</td>
</tr>
</tbody>
</table>