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College professors' perceptions of the advantages and disadvantages of mobile computing

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COLLEGE PROFESSORS' PERCEPTIONS OF THE ADVANTAGES AND DISADVANTAGES OF MOBILE COMPUTING

by

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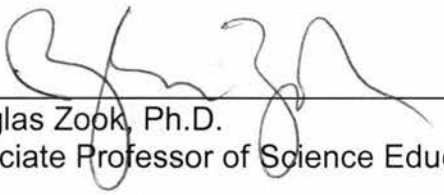

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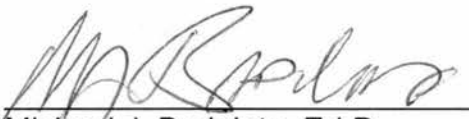

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DEDICATION

This dissertation is dedicated to my beloved wife, Sri Irianti, and my two precious daughters: Najmia Chakri Amirina and Naufa Fulbrita Amirani. If I could, I would share the doctoral degree with them because they have been bearing the trials and tribulations of my doctoral experience in the last five years in a faraway land, half way around the globe from our country, Indonesia. I hope the doctoral degree enables me to help others and to promote the values of freedom, love, and humanity to our mankind.

I would also dedicate this dissertation to the Stephens Family of Marblehead, Massachusetts, USA. Dr. Robert and Dorothy Stephens have made it possible through scholarships for Indonesian teachers to pursue graduate degrees at Boston University School of Education. The Kelly E. Stephens Memorial Scholarships is in memory of their beloved daughter, the late Kelly Elizabeth Stephens, who was passed away in Krakatau Island while tirelessly teaching English to refugees, college students, and government officers in Indonesia. I am honored to pass on her legacy as a good teacher.

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Before accepting me as a doctoral student in his program, Dr. David Whittier asked me an important question: "What is the difference between an audience and learners?" Although I had worked as a journalist for almost 11 years, I did not distinguish them clearly. I thought that they meant the same thing. In fact, they are not. Since then, I have been paying more attention to whom I pass information, knowledge, and lessons. I thank David not only for this, but for all his passionate support from the beginning to the end of my doctoral study.

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COLLEGE PROFESSORS' PERCEPTIONS OF THE ADVANTAGES AND DISADVANTAGES OF MOBILE COMPUTING

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ABSTRACT

This study employed quantitative and qualitative methods and was conducted in two phases: (1) survey of 30 professors in summer 2003, and (2) case study of five professors in fall 2003. The main research question was "*what do college professors perceive to be the pedagogical advantages and disadvantages of mobile computing in courses that require its use by students?*"

The study showed that the most important pedagogical advantages of mobile computing were (1) "*improving professor-student communication*," (2) "*encouraging collaboration in common experience where students learn in groups that would improve their teamwork skills*," and (3) "*improvement in their capabilities as faculty in designing assignments that meet student needs.*" The pedagogical disadvantage was "*too many e-mails to read.*" This study also found that many professors were working on the computer off and on campus. Some of them even worked beyond evening to early morning hours, and also during the weekend.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GLOSSARY

For the purpose of this study, the researcher defines the following terms:

Pedagogy: "The study of methods and styles of teaching" (Hornby, 1995: p. 853). Furthermore, "Pedagogic" means educational, academic, professorial, teaching, scholastic, instructional, tutorial, and pedantic. "Pedagogical" is the adjective of pedagogy and means, "concerning teaching methods" (p. 854). Pedagogy is also defined as "the art, practice or profession of teaching" (Good, 1945: p. 290) or "the science and art of teaching" (Monroe, 1913: p. 621).

Pedagogical advantages: educational benefits resulting from the use of mobile computers in classrooms. For example: research can be faster and more thorough.

Pedagogical disadvantages: negative conditions that derived from students' use mobile computers in the classroom. For example: students are chatting on-line when the class is in session.

Mobile computing: Pertaining to computing that is performed on a portable computer or a handheld device by a user who is moving among various locations and may be using different types of network connections such as, dial-up, Local Area Network, or wireless (International Business Machine, 2001). Mobile computing may apply to a variety of devices, such as Personal Digital Assistant or palm pilot, tablet PC, laptop, and notebook computer.

Laptop or notebook computer: A lightweight personal computer. Notebook computers typically weigh less than 6 pounds and are small enough to fit easily in a briefcase. Aside from size, the principal difference between a notebook computer and a personal computer is the display screen. Notebook computers use a variety of techniques, known as flat-panel technologies, to produce a lightweight and non-bulky display screen.

Wi-fi: A short phrase for wireless fidelity. This is another name for the IEEE 802.11b standard. It is a trade term promulgated by the Wireless Ethernet Compatibility Alliance (WECA). "Wi-Fi" is used to describe 802.11b in the same way that "Ethernet" is used to stand for IEEE 802.3. Products certified as Wi-Fi by WECA are interoperable with each other even if they are from different manufacturers. A user with a Wi-Fi product can use any brand of Access Point with any other brand of client hardware that is built to the Wi-Fi standard (Syracuse University, 2004).

802.11b: This term applies to wireless Local Area Networks (LANs) and provides 11 Mbps transmission (with a fallback to 5.5, 2 and 1 Mbps depending on Range and Signal Strength) in the 2.4 GHz band. An 802.11b protocol uses only DSSS (Acronym for "*direct-sequence spread spectrum*." DSSS is one of two types of spread spectrum radio.) 802.11b was a 1999 IEEE protocol to the original 802.11 standard, allowing wireless functionality comparable to Ethernet (Syracuse University, 2004).

Wireless laptop course: A course that is conducted by a professor who incorporates the use of laptop computers and wireless technology into his or her curriculum. The professor comes to a classroom, meets and teaches students who bring their wireless laptops to the classroom. They can access the Internet from inside and outside of the classroom with wireless Local Area Network (LAN) cards that attach to their laptops to communicating with wireless access units, which are located across campus in the academic buildings, library, college center, and residence halls. The professor put syllabus and other course materials on-line through a course website. The professor encourages students to visit the web site and to download additional materials. Some professors use the site also for on-line discussions, announcements, on-line quizzes, and students' profiles. Therefore, wireless laptop course is a traditional classroom with additional technology, such as laptop computer, wireless LAN, and course web sites, that enables students and professors to use the Internet to expand their learning resources.

CHAPTER 1: INTRODUCTION

History informs us that technology applied in the classroom can assist and even improve teaching when used appropriately (Saettler, 1990). It also tells us that not all technology in education has worked as planned. Cuban, in referring to common and traditional practice observes that, "Those who have tried to convince teachers to adopt technological innovations over the last century have discovered the durability of classroom pedagogy" (Cuban, 1986: p. 109). Tyack and Cuban (1995) stated that an important condition of any reform process, including technology application in the classroom, should start from the problems teachers have identified, rather than those identified by non-teachers. One should consider the teachers' beliefs concerning teaching methods to make the technology work as the teachers want it to.

The decision on whether to utilize technology productively and effectively in teaching and learning is influenced by teachers' and professors' perceptions of the advantages and disadvantages of the technology. A study of the perceptions of 27 high school mathematics teachers of graphing calculators by Simonsen & Dick (1997) concluded that teachers' perceptions that calculator use would be beneficial to learning in their classrooms at all stages of preparation of calculators were essential for a successful implementation. Mobile computer such as wireless laptop computer has more features and software programs than the graphing calculator does. In addition to word-processing and spreadsheet, a wireless laptop computer can also connect to the Internet for on-line activities,

such as reserving books from library, searching information, reading papers, and e-mail or instant message communication. Hence, teachers' perception of mobile computing could be an important prediction of success. Mobile computing is a computer-related activity that is performed on a portable computer or a handheld device by a user who is frequently moving among various locations and may be using different types of network connections (International Business Machine, 2001). Dwyer, Ringstaff, and Sandholtz (1990), Cuban (2001), and Windschitl and Sahl (2002) found that programs for implementing computer technology in the classroom should consider teacher's beliefs about effective teaching and how the computer can be utilized to support his or her teaching activity. Indeed, in a study of computer use in college level, accessibility to the hardware was one of the most frequent requests faculty raised in addition to training and ease of use of specific media (Groves and Zemel, 2000).

In response to the demand for access to computing, mobile computing devices such as wireless notebooks and laptop computers have become more prevalent on-campus. According to Green (2003) who has been conducting a campus-wide survey on computer use in US higher education since 1990, 77.2% or roughly four-fifths of 632 two-year and four-year, public and private colleges in the US claimed that they have functioning wireless Local Area Networks. In similar surveys in 2002, 2001, and 2000, the percentage was about 67.9%, 50%, and 29.6% respectively. However, the development of wireless infrastructure

was not necessarily followed by the implementation of a school policy that required students to own wireless laptop computers because governments, school administrators, and parents must finance the purchase of laptop computers for the students.

The cost in implementing a policy that requires students to own laptop computer is significant. For example, in October 2000, the Massachusetts Board of Higher Education launched a $123 million plan to require all students at the University of Massachusetts and other public colleges to buy and use their own laptops. The initial three-year plan, which would require state funding, includes a $54 million proposal to discount the price of the computers and provide full and partial vouchers for low-income students to purchase them (Healey, 2000). Green (2001) found that only 14% of public and 19% of private 4-year colleges, "agree/strongly agree" with the statement "we intend to require all our students to own a computer by fall 2003." Many states have put the policy on hold for now due to budget cuts. Nevertheless, Green (2003) reported that several colleges in the United States have taken it upon themselves to implement a policy requiring all freshman students to own laptop computers with wireless capability. Hence, a college that has been implementing this policy is an appropriate location to investigate college's professors' perceptions of the advantages and disadvantages of mobile computing. This study was conducted at Suburban State College, a pseudonym for a state college in northeast of the United States

that has implemented a campus-wide policy to require incoming freshman students to own wireless laptop computer since fall 2002.

OBJECTIVE OF THE STUDY

The objective of this study was to describe college professors' perceptions of advantages and disadvantages of mobile computing in the courses they teach. An elaborated sub-objective was that the study would provide an in-depth and comprehensive list of pedagogical advantages and disadvantages of mobile computing. The primary research question that guided this study was:

> What do college professors perceive to be the pedagogical advantages and disadvantages of mobile computing in courses that require its use by students?

To better describe and seek explanations of the professors' perceptions, the study also addressed the following questions:

1. Was there a correlation between participating college professors' teaching methods and their perceptions of pedagogical advantages and disadvantages of mobile computing?
2. Was there a correlation between participating college professors' teaching styles as defined by Grasha and Yangarber-Hicks (2000) and their perceptions of pedagogical advantages and disadvantages of mobile computing?
3. Was there a correlation between college professors' stage of technology competency as defined by the Apple Classrooms of

Tomorrow (ACOT) project and their perceptions of pedagogical advantages and disadvantages of mobile computing?

4. Was there a correlation between college professors' mobile computer use and their perceptions of pedagogical advantages and disadvantages of mobile computing?

HYPOTHESES OF THE STUDY

For the purpose of this study, at least four outcomes were predicted as null hypotheses:

Null hypothesis 1: Subjects' teaching methods do not correlate with their perceptions of the advantages and disadvantages of mobile computing. Teaching method was defined as the instruction technique faculty used to deliver subject matters to his or her students. This study employed five teaching methods commonly used in college level based on Grasha & Yangarber-Hicks (2000) and Grasha (2002) observations: (1) Lecture, (2) Discussion, (3) Students lead the class, (4) Students work on projects, and (5) Combination of the four methods.

Null hypothesis 2: Subjects' teaching styles do not correlate with their perceptions of the advantages and disadvantages of mobile computing. Teaching style was defined as description of prevalent aspects of faculty presence in the classroom that represented typical orientations and strategies college faculty use in teaching. The subjects chose teaching style they used from five teaching styles based on Grasha (1996) and Grasha & Yangarber-

Hicks (2000) studies: (1) Expert, (2) Formal Authority, (3) Personal Model, (4) Delegator, and (5) Facilitator.

Null hypothesis 3: Subjects' stages of technology adoption do not correlate with their perceptions of the advantages and disadvantages of mobile computing. Stages of technology adoption was defined as gradual changes of teacher's use of technology from lower level such as "learning the basics of new technology" to the highest level such as "discover new uses of technology." This study employed the categories that used a study that Dwyer, Ringstaff, and Sandholtz (1990) derived from the Apple Classroom of Tomorrow research that described the adoption stages, from lower to higher, as (1) Entry, (2) Adoption, (3) Adaptation, (4) Appropriation, and (5) Invention.

Null hypothesis 4: Subjects' mobile computer use do not correlate with their perceptions of the advantages and disadvantages of mobile computing.

SIGNIFICANCE OF THE STUDY

Previous studies have largely concentrated on limited aspects of advantages of mobile computer use, for example Apple Computer Inc. (1995) and Rockman (2000). This study investigated both the advantages and disadvantages of mobile computing from the college professors' points of view. A greater insight into perceived advantages and disadvantages could help faculty and college administrators to determine both benefits and obstacles of using mobile computing in the classroom. This knowledge could lead to improvements in the quality of teaching by reducing the factors that create the disadvantages

while preserving and strengthening the advantages. Furthermore, this study would give both the administrators and faculty valuable feedback on several aspects of teaching activities when implementing a campus-wide policy that requires students to own laptop computers. For example, shifting faculty's teaching method from lecture-dominant class into discussion-dominant class to facilitate student and faculty interaction.

Potential advantages of this study include data and findings that may inform financial decision-making. Budget administrator may learn more about where money may be spent that would most likely improve teaching and learning. Although this study did not investigate the cost or other financial consequences of the mobile computing use in higher education, this study provided valuable information on the benefits faculty members derived from employing wireless technology in their classrooms. Higher education administrators can help professors by providing equipment and in-house training about using computer applications that support these benefits for their courses. In the process, the college administrator can help professors to move into higher stages of technology application in their courses and classroom.

This study can also inform college professors about the correlation between their teaching styles with the advantages and disadvantages of mobile computing. For example, some styles were clearly associated with either perceived advantages or perceived disadvantages of mobile computing. This study would help further knowledge of the effective use of mobile computing. By

knowing the correlations between teaching methods, teaching styles, technology adoption stage, and percentage of mobile computer use in the classroom, and advantages or disadvantages of mobile computing, the college professors can draw a mental model of appropriate teaching practice for a course that requires students to own wireless laptops. This study may also help the professors to more wiesely spend time and money related to the use of mobile computing.

This study examined the impacts of mobile computing on traditional classroom instruction, such as the possibility that mobile computing maybe a distraction to the learning and teaching process, and of blurring the boundary between classroom and home, work and leisure. The case study part of this study in particular describes some strategies for dealing with distraction and time management issues.

This study provides data and information that may help higher education administrators in designing curriculum and courses for their colleges by taking the college professors' perceptions into consideration in optimizing teaching and learning with mobile computing.

SCOPE OF THE STUDY

The participants of the study were college professors at a state college in the northeast area of the United States. The study was accomplished in two phases. In phase 1, a survey was conducted using quantitative methods. This survey was followed by phase 2, a case study of some of respondents in the survey in phase 1. Participants of the case study were recruited from the survey

respondents who volunteered to participate in phase 2 of the study. The participants filled out a blank form in the end page of the survey that confirmed their willingness to be available for three classroom observations and two interviews for the second phase of the study.

LIMITATIONS OF THE STUDY

This study has several limitations. The first limitation is that, although the participants of this study are faculty members, they were drawn from the population of one college and they were not randomly selected.

The second limitation was this study employed survey and interviews. Consequently, the study has the limitation of all self-reporting data, such as incompleteness and high-degree of subjectivity. To reduce these potential disadvantages, additional data sources were employed, such as direct and videotaped observations in the classroom where the participant taught. The observations were utilized to triangulate participants' responses in the survey in phase 1 to investigate their selected teaching styles and their practice in the classroom. The case study also reviewed the participants' syllabi and e-mails correspondence with the researcher as additional sources of data that gauge the accuracy of the self-reported data sources.

CHAPTER 2: REVIEW OF THE LITERATURE

The idea of distributing a laptop to every student in the classroom has been emerging since the technology became available in the market in the 1990s. In October 1991, Apple Computers released the Macintosh Powerbook series. A year later, IBM released its Thinkpad laptop series (About Inc, 2004). Beginning in 1995, Apple, IBM, Microsoft, Toshiba, Dell, and Gateway have been promoting laptop computer use in schools and colleges. Some higher education institutions have moved further by requiring students to own and use laptop computers. Brown (2004) reported that more than 200 post-secondary institutions worldwide required at least some of their students to use laptops.

A survey of higher education institutions in the US and Canada in 2002 revealed that approximately 59% of the institutions surveyed had implemented wireless networks allowing their students to use their laptop more ubiquitously on-campus (Educause Center for Applied Research, 2002). Furthermore, the survey also revealed that currently 94% of laptop computers were used to access the wireless network, followed by desktop computers with 46% and palm pilots with 39%.

ADVANTAGES AND DISADVANTAGES

The purpose of this study was to learn if faculty perceive that mobile computing, primarily facilitated by wireless laptops, gives more advantages than disadvantages to teaching at Suburban State College. Table 1 summarizes the findings of 23 studies of laptop computer or mobile computing devices from 1994

Table 1. Previous studies on the use of laptop computer in the classroom

Table 1. Previous studies on the use of laptop computer in the classroom

Author(s) and year	K-12 or Higher Education (HE)	Wireless (W)/Hardwired (H)	Advantages							
			Flexibility	Motivation	Collaboration	Presentation	Attendance	Job skill	Academic achievement	Learning after school
Gardner (1994)	K-12	H		x						
Dwyer (1994)	K-12	H			x			x	x	
Jeffrey & Carol (2003)	K-12	H			x	x				
Rockman (1998)	K-12	H		x	x			x	x	x
Rockman (2000)	K-12	H	x	x	x			x	x	x
Stevenson (1998)	K-12	H							x	
Fisher & Stolarchuk (1998)	K-12	H							x	
Kiaer (1998)	K-12	H								x
Peterson (1999)	K-12	H		x	x	x				
Roschelle (1999)	K-12	H								
Albion (1999)	K-12	H								
Fisher (1999)	K-12	H						x		
Yakimovicz & Murphy (1995)	HE	W		x	x					
Kiaer (1998)	HE	W	x	x	x					
Kraut et.al. (1998)	HE	W								
Griffith et.al. (1999)	HE	W					x		x	
Dryer et.al. (1999)	HE	W								
Lim (1999)	HE	W			x		x			
O'Toole (2000)	HE	W								
Grace-Martin & Gay (2001)	HE	W							x	x
Fox (2001)	HE	W	x		x					
Varvel, Jr. & Thurston (2002)	HE	W	x		x					

to 2003. The most frequently cited advantages of mobile computing were academic achievement, collaboration, higher retention rate and attendance record, better presentation, and writing. The most frequently cited disadvantages were unfounded benefits, distraction, loneliness, and isolation. None of these studies mentioned cost or fragility of the mobile computing as disadvantages.

Simonsen & Dick (1997) investigated 27 high-school teachers' perceptions of graphing calculator and found that the teachers' perceptions of the advantages appeared to be instructionally related, whereas the perceptions of the disadvantages appeared to be primarily logistical in nature. They also reported that dynamics of a classroom tended to shift to more discussion, inquiry, and cooperative learning. The study also reported teachers' considerable reluctance to deviate from stringent curriculum requirements that were reinforced by standardized tests.

The top three of most frequently cited advantages of mobile computing devices were academic achievement, collaboration, and improved writing (Gardner, 1994; Fouts & Stuen, 1997; Fisher & Stolarchuk, 1998; Rockman, 1998, 2000; Stevenson, 1998, 1999; Peterson, 1999; Griffith et al., 1999; Schiff & Solmon, 1999; CRF and Associates, Inc., 2000). A reduction of learning time was also mentioned (Baker, et al., 1997), and Armstrong (1998) cited the ease of updating lecture materials and consistency of information delivery from class to class as advantages to instructors.

Many authors, however, have criticized those claims. Russell (1999)

suggested that mobile computing has not made a significant difference in learning. On the other hand, teachers who used mobile computing might change their social life style, such as more work to do at home (Oppenheimer, 1997; Kraut, et al., 1998; Rosenberg, 1998; Dryer, et al., 1999; O'Toole, 2000; Howell, 2001).

Grace-Martin and Gay (2001) in a study of mobile-wireless computing program in two undergraduate courses at Cornell University indicated that it could both enhance a learning environment and harm students' grades in some cases. Gay stated what may be an obvious conclusion in writing, "Just putting them in the classroom could be a curse, but if we think it through, there could be terrific benefits" (Carlson, 2001). Some college professors complained that mobile computing has distracted their students from learning in their classrooms (Educause Center for Applied Research, 2002; Schwartz, 2003). Schwartz, however, cited a professor expressing an optimistic view by reporting that mobile computing has challenged him to teach better because he must provide interesting teaching materials that encouraged students to pay attention to the class. A wireless laptop helped him to show cases that were available on the Internet.

TEACHING METHOD

Grasha (2002) stated that "the preferred instructional practices of teachers" describes their methods of teaching (p. 2). The instructional practices are also recognized as teaching method. According to Grasha, a professor

practicing the most traditional lecture teaching method spends approximately 70% of their time sharing information in a one-way communication pattern. Eble (1988) observed that, despite the emergence of book, television, and other technology in learning, lecture still a favorite teaching method among the faculty and has been used for more than 400 years because human beings like to interact with other consenting humans.

Discussion as another teaching method also exists in higher education. Massy & Zemsky (1994) described that "discussion classes are characterized by heavy students involvement, but the instructor retains responsibility for organizing materials and carrying out the discussion" (p. 5). Grasha (2002) added that, in discussion, generally professor takes certain roles, such as moderator who will guide the conversation, questions and answers among students so the activity stays on its basic theme of the day. Eble (1988) stated that good discussion can move student from passive learning to active participation.

Olsen & Simmons (1996) recommended that colleges must encourage faculty to use active learning techniques and hands-on experience for their students. Role play and a student or two lead the class, or also known as "student teacher of the day," are useful to make students more active in learning than lecture method. In students lead the class teaching method, the professor assigns students into small groups of five or seven. Each group will have

designated members as the teachers for each of the course topics during the whole semester.

Another teaching method that is usually found in technologically rich classroom is students work on projects (Grauerholz, Mckenzie & Romero, 1999). Mobile computing with wireless Internet connection has opened the classroom boundary and allowed students to access academic resources outside of their campus. In this environment, a professor assigned students to work on several projects to be completed during the semester. The professor helps students to work on projects that can be done individually or in groups. Nevertheless, in the advent of wireless network computer on campus, Grauerholz, et al. (1999) cautiously reminded college professors that:

> "As the classroom becomes more supplemental, so too might the teacher's role *within* the classroom. As our knowledge of the *hows*, *whens*, and *whys* of lecturing and discussion become more sophisticated, teachers are encouraged to adopt the role of facilitator rather than expert or truth bearer" (p. 586).

TEACHING STYLE

Grasha (1996) argued that teaching style was a set of personal qualities related to the teacher's preferences for particular instructional processes. He proposed five teaching styles, such as "Expert," "Formal Authority," "Personal Model," "Facilitator," and "Delegator." Grasha observed that lecture and discussion would reinforce "Expert" and "Formal Authority" styles, while independent research projects would reinforce "Expert," "Facilitator," and "Delegator" styles.

Using the teaching style category, Grasha & Yangarber-Hicks (2000) surveyed two samples of college faculty members to investigate the match between their teaching styles and the use of instructional technology. Their independent variables were type of courses, the teaching styles of faculty (Table 2), faculty's perception of students' learning style in each course, students' satisfaction with their courses, and students' grade.

Table 2. Definitions of five teaching styles

Teaching styles	Definitions
Expert	Possesses knowledge and expertise that students need. Strives to maintain status as an expert among students by displaying detailed knowledge and by challenging students to enhance their competence. Concerned with transmitting information and insuring that students are well prepared.
Formal authority	Possesses status among students because of knowledge and role as a faculty member. Concerned with providing positive and negative feedback, establishing learning goals, expectations, and rules of conduct for students. Concerned with the correct, acceptable, and standard ways to do things and with providing students with the structure they need to learn.
Personal model	Believes in "teaching by personal example" and establishes a prototype for how to think and behave. Oversees, guides, and directs by showing how to do things and encouraging students to observe and then to emulate the instructor's approach.
Facilitator	Emphasize the personal nature of teacher-student interactions. Guides and directs students by encouraging cooperative as well as independent learning activities. Good at questions, exploring options, suggesting alternatives, and encouraging students to make informed choices. Overall goal is to develop in students the capacity for independent action, initiative, and responsibility. Works with students on projects in a consultative fashion and tries to provide as much direction, support, and encouragement as possible.
Delegator	Concerned with developing students' capacity to function in an autonomous fashion. Interested in having people become self-directed, self-initiating learners. Students work independently on projects or as part of autonomous teams. The teacher is available at the request of students as a consultant and resource person.

(Source: Grasha & Yangarber-Hicks, 2000, Integrating Teaching Styles and Learning Styles with Instructional Technology, *College Teaching* 48/1, p. 5)

The first sample was a group of 40 presenters from a regional conference on the uses of technology in higher education. The second sample was a random selection of 200 individuals out of 1,000 participants attending a national-level conference on a similar topic. From both samples, the researchers collected 50 completed surveys (divided as N1=14 and N2=36). Grasha & Yangarber-Hicks found that there were no significant differences in the average teaching style scores between courses for each of the five teaching styles (Table 3). Relevant to this study, the researchers concluded that the subjects' teaching styles did not affect their use of instructional technology.

Table 3. Mean teaching style scores on the Teaching Style Inventory

Styles	Technology courses*	Traditional courses*
Expert	4.8	4.71
Formal authority	5.35	5.56
Personal model	5.23	5.18
Facilitator	5.27	5.23
Delegator	4.79	4.53

(Source: Grasha & Yangarber-Hicks, Winter 2000, Integrating Teaching Styles and Learning Styles with Instructional Technology, *College Teaching* 48/no. 1, p. 2-10).
Note: *) A seven-point Likert scale was used, and teachers indicate the extent to which they agree or disagree with each item. The higher the score on the inventory, the more someone agrees with the statements about that style. The average scores on the Teaching Styles Inventory are shown for 50 technology-based courses and for a corresponding set of 50 courses taught in a more traditional manner by the same teachers. The inventory is a 40-item assessment instrument and has eight items for each of the five teaching styles.

The five teaching styles by Grasha & Yangarber-Hicks (2000) were developed from Richard Mann's study on the roles that teachers typically play in the classroom. Mann, Arnold, Binder, Cytrunbaum, Newman, Ringwald, and Rosenwein (1970) studied teaching styles in college and identified six teacher styles. Those six styles were expert, formal authority, socializing agent, facilitator, ego ideal, and person (Mann, et al., 1970). Two styles that have disappeared in Grasha & Yangarber-Hicks's (2000) study were socializing agent and ego ideal. On the other hand, the new study suggested a new style called delegator. Nevertheless, one's teaching style is not one clear-cut style uniformly distant from other styles. According to Fuhrmann & Grasha (1983), one way to evaluate one's teaching style is by using rank number from 1 to 6 where 1 indicates the style that fits best with one's teaching style and 6 indicates the style that is least like one's teaching style.

TEACHING STYLE AND TECHNOLOGY

In academia, providing a laptop computer for each student has not been universally recommended. The laptop is another type of machine that, according to Cuban (1986), if not properly implemented could undermine classroom stability. In a 2001 report, Cuban observed K-12 schools and Stanford University in the Bay Area of San Francisco and eventually came up with a question: "Why fewer than two of every 10 teachers are serious users of computers in their classrooms?" Cuban uses the history-and-contexts explanation that approaches the question from a perspective of circumstances

around the teaching profession. He said that teachers would adapt to new technology to support existing teaching practices (p. 173). He added that teachers were concerned about the time spent preparing the computers, the nervousness related to the potential unreliability of computers, such as possible server crash and software problems, and the difficulties associated with the computer technology itself, including "rampant featurism" - a notion that describes how computer industries tend to keep adding new functions, hence making software harder to use.

Cuban, Kirkpatrick, and Peck (2001) found that teacher resistance or technophobia of computer use did not explain the low incidence of teacher use of computers in instruction. However, they also reported that there were problems in facilitating the teachers' aspirations to learn new skills in computing. Cuban et al. (2001) said that most teachers cited two problems. First, teachers do not have the time to find and evaluate software or to produce their own. Second, computer and software training is seldom offered at convenient times. Also, computer skill trainings offered by school districts were often too general and "irrelevant to teachers' specific needs" (Cuban, et al., 2001: p. 826). In addition, a number of studies cited the strong correlation between teachers' use of mobile computer and the changing of their teaching styles, such as more student-oriented (Becker & Ravitz, 1999; Bull, Bull, Garofalo, & Harris, 2002) and constructivist approaches (Windschitl & Sahl, 2002; Fox, 2001). This study did not intend to investigate this correlation. Rather, investigated the relationship

between teachers' teaching styles and their perceptions on mobile computing.

TEACHERS' TECHNOLOGY ADOPTION STAGE

Teachers' use of technology depends on their position in technology adoption stage as one of the conclusions of a 10-year study that was sponsored by Apple Computer Inc. The study that was conducted between 1985 and 1995 was called Apple Classrooms of Tomorrow (ACOT) study and using elementary schools as its research setting. This project was aimed at answering an important question: "What happens to students and teachers when they have access to computers whenever they need it?" One of the results was a conclusion that teachers progress through certain stages as they incorporate technology into their classrooms (Table 4). An important criterion for the ACOT classroom was that teachers and students utilized computer technology as a tool for learning and a medium for thinking, collaborating, and communicating.

Dwyer, Ringstaff, and Sandholtz (1990) found that teachers in ACOT classrooms went through intense inner conflict as they explored alternative approaches that contrasted with their beliefs about teaching and learning. Analyzing data sources such as teacher journals, weekly reports, classroom observations and interviews of 32 teachers and 650 students, Dwyer et al. (1990) concluded that teachers' beliefs about instruction and schools were important factors in technology adoption. Furthermore, teachers did not change their beliefs quickly. Changes occurred over time and in identifiable stages. Teacher's changing to deploy computing was a gradual process deemed: "an

erosion of the old, an accretion of the new" (Dwyer, et al., 1990: p. 3). The researchers framed this gradual evolution as passing through five identifiable stages: Entry, Adoption, Adaptation, Appropriation, and Invention. The study found that once the instruction with technology began, experienced teachers in Entry stage of technology use encountered one of the common first-year-teacher problems: personal frustration. Teachers in Invention stage, however, were having fewer problems and expressed positive perceptions toward technology in the classrooms. A summary of the ACOT stages is presented in Table 4.

Table 4. Stages of technology adoption among teachers

Stage	Examples of what teachers do
Entry	Learn the basics of using technology
Adoption	Use new technology to support traditional instruction
Adaptation	Integrate new technology into traditional classroom practice (Here, they often focus on increased student productivity and engagement using word processors, spreadsheets, and graphic tools).
Appropriation	Focus on cooperative, project-based, and inter-disciplinary work-incorporating the technology as needed and as one of many tools.
Invention	Discover new uses of technology tools, for example developing spreadsheet macros for teaching algebra or designing projects that combine multiple technologies.

(Source: Apple Computer, Inc. (1995). Changing the Conversation about Teaching, Learning, & Technology: A Report of 10 Years of ACOT Research. Available on-line at <http://www.apple.com/education/k12/leadership/acott/library.html>)

Although the focus of ACOT was elementary and middle school teaching, its application on higher education is feasible. According to Athanasopoulos (2003), the stages of technology adoption among college professors have more similarities than differences with teachers in elementary education. Fox (2001)

observed that in higher education, computer technology would change teaching style if the instructors reach a certain level of technology adoption. He proposed a model comprised of four elements: (1) new pedagogical opportunities, (2) changed work practices, (3) technology non-neutrality, and (4) unintended consequences of new technology adoption. He divided new pedagogical opportunities into two levels. First, new opportunities to do the same thing the faculty members have always done, just adding the technology to it to make teaching more efficient. Examples of this level are Power Point presentations and providing students with lecture materials in advance on the Internet. Second, new opportunities to enable faculty members to do something different. Examples of this level are teaching method that asks students to use simulation programs on the World Wide Web, to communicate, collaborate, and interact with other students from various educational institutions around the world to solve various problems and activities. Few college professors have moved from the first level to the second level (Fox, 2001).

Knutel (1998) conducted a qualitative study in higher education and found that technology adoption in a university varied according to departments. He interviewed 16 college professors and concluded that integrating technology into teaching and learning was complex because every professor had unique preferences. He suggested further research that could elaborate the professors' perceptions on technology use in their individual courses.

POST-MODERNISM PROFESSIONALISM

Computer technology, and especially the one that is capable of connecting to the Internet through a wireless network would influence teachers' work inside and outside the classroom. As Cuban (1986) observed, teachers would teach and use technology that met their needs. Teachers would maintain their professionalism regardless the technology. Sockett (1987) characterizes professionalism as an amalgam of character, commitment, participant knowledge, and pedagogical knowledge and those are not essentially classroom-oriented attributes. Fisher (1999) claims that mobile computing helps teachers to acquire a so-called "*Post-modernism professionalism*," that is measured by teachers' ability to work in any place at any time, further blurring the distinction between home and school, work and leisure (Fisher, 1999).

Although it is very hard to define post-modern in clear-cut phrases, Jean Francoise Lyotard (1984) defines postmodernism as scepticism toward metanarratives. He argued that no set of rules can accurately explain knowledge. Therefore, one should not settle his or her idea onto something based on privileging an argument or a theory over the other without acknowledging the diversity of opinions. For example, the idea that implementing wireless network on-campus will enhance learning process. In fact, the humans - teachers and students - might suffer because they never have a chance to take a rest or contemplate the information they get.

According to Ryder & Wilson (1996), information technology enables the transition from modern to post modern. He selected the availability of Aristotle's "Rhetoric" through the Internet as an example of post-modern era vis-à-vis the book in physical form as the product of modern era. The Rhetoric in its electronic form is cheaper, reliable, and linkable. Indeed, the post-modern technology increasingly helps learners to easily obtain different perspectives and analysis on a virtually infinite number of ideas, theories, or arguments (Landow, 1994).

Hlynka & Yeaman (1992) argued that the characteristics of post-modernity were plurality and recognition that if there are multiple ways of knowing then there must be multiple truths. They gave an example: the paradigm shift in educational technology that seems like a modernism phenomenon is actually a post-modernism view that supports humanistic way of knowing with criticism as its mode of operation. They added that science and technology as the output of modernism have positive and negative side effects. Therefore, according to Wilson (1997), post-modernism sees technology advancement in educational technology as a double-edge sword with both advantages and disadvantages.

Fisher (1999) observed that the teaching profession has evolved from modernism to post-modernism. He cited Hargreaves & Goodson (1996) who identified five forms of professionalism in this regard. Those professionalism forms are (1) classical; (2) flexible; (3) practical; (4) extended; and (5) complex.

Hargreaves & Goodson (1996) considered classical professionalism as a modernist view - while the other four are post-modernism forms -- because

classical professionalism in the teaching profession shared similar characteristics with other highly ranked, publicly recognizable, and largely male-dominated professions such as lawyer and medical doctor. Those characteristics were:

> "…a specialized knowledge base or shared technical culture, a strong service ethic with a commitment to meeting clients' needs, and self-regulated, collegial control rather than external bureucratic control over recruitment and training, codes of ethics and standards practice." (Hargreaves & Goodson, 1996: p. 5).

In fact, according to Hargreaves & Goodson, social change makes the teaching profession and its classical model, such as lawyer and doctor, share those characteristics with other professions as well. For example, Harvey (1989) argued that globalization has defined new divisions of labor and flexible economies, and globalization has been leading to fundamental changes in people's working lives. Therefore, based on Harvey's argument, Hargreaves & Goodson (1996) proposed using a postmodernism approach to observe the teaching profession due to its changing environment.

In addition to technical competency and subject knowledge, Hargreaves & Goodson concluded that teacher professionalism must also consider new principles that demonstrate its complexity in a postmodern era (1996: p. 20-21). In this framework, teacher professionalism has seven principles:

1. Increased opportunity and responsibility to exercise discretionary judgment over the issues of teaching, curriculum and care that affect one's students.

2. Opportunities and expectations to engage with the moral and social purposes and value of what teachers teach, along with major curriculum and assessment matters in which these purposes are embedded.
3. Commitment to working with colleagues in collaborative cultures of help and support as a way of using shared expertise to solve the ongoing problems of professional practice, rather than engaging in joint work as a motivational device to implement the external mandates of others.
4. Occupational heteronomy rather than self-protective autonomy, where teachers work authoritatively yet openly and collaboratively with other partners in the wider community (especially parents and students themselves), who have a significant stake in the students' learning.
5. A commitment to active care and not just routine service for students. Professionalism must in this sense acknowledge and embrace the emotional as well as the cognitive dimensions of teaching, and also recognize the skills and dispositions that are essential to committed and effective caring.
6. A self-directed search and struggle for continuous learning related to one's own expertise and standards of practice, rather than compliance with the enervating obligations of endless change demanded by others (often under the guise of conti

Fisher (1999) concluded those seven principles imply high levels of individual agency, that is, "the power of the individual to do things and to effect change" (p. 5). He employed data from a study called the Multimedia Portables for Teachers Pilot (MPTP) on 569 schools in England. He found that portable computers could help teachers experience the nature of post-modernism that is flexible, adaptable, sensitive to context, and non-prescriptive. A study of mobile computing in college setting therefore was useful to further describe professors' post-modernism professionalism values. In college, professors teach their classes in different setting than elementary schools. Usually, a professor teaches one course once a week, while an elementary school teacher teaches everyday. College professors certainly teach students who are older and ready to learn more independently. Observing professors' perceptions of mobile computing and simultaneously their practice of post-modernism professionalism would explain the similarity and difference with their colleagues in elementary schools.

Teaching Method, Teaching Style, Technology Adoption Stages, and Post-modernism Professionalism were observed in this study related to other variables such as Teaching Methods and the time allocation for mobile computing use in the subjects' classrooms. This study employed further of previous studies, primarily those by Grasha & Yangarber-Hicks (2000), Dwyer, Ringstaff, and Sandholtz (1990), and Hargreaves & Goodson (1996) to dissect the college professors' perception of mobile computing.

CHAPTER THREE: RESEARCH DESIGN

The objective of the study was to describe college professors' perceptions of the disadvantages and advantages of mobile computing in the courses they teach. The expectations were that the study would provide an in-depth and comprehensive list of pedagogical advantages and disadvantages of mobile computing. The primary research question that guided this study was:

What do college professors perceive to be the pedagogical advantages and disadvantages of mobile computing in courses that require its use by students?

The participants of this study were college professors. The independent variables were: (1) professors' teaching style as defined by Grasha & Yangarber-Hicks (2000); (2) professors' stages of technology adoption as defined by a 10-year study of Apple Classroom of Tomorrow (ACOT); (3) professors' teaching methods, and (4) professors' mobile computer use in their classrooms. The dependent variable is participants' perceptions of mobile computing.

Their perceptions were classified into two groups: advantages and disadvantages. Faculty perceptions were considered an advantage if the perception indicated an educational benefit from the use of mobile computers in the classroom. On the other hand, a perception was classified a disadvantage if the perception indicated negative conditions from the use of mobile computers in the classroom.

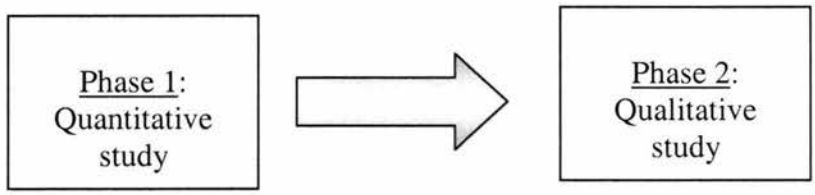


Figure 1. Two stages of study on faculty's perceptions toward the advantages and disadvantages of mobile computing in the classroom.

This study employed a combination of quantitative and qualitative methodologies. According to Kelle (2001), this combination yields insights about the investigated social phenomenon. In order to achieve a comprehensive and an in-depth knowledge of the participants' perceptions, this study employed the two methodologies in a sequence of two phases. Quantitative method in phase 1 in the form of survey and qualitative method in phase 2 in the form of case study. In addition, according to Parlett & Hamilton (1977), a survey must be contextualized by collecting observation and interview, two instruments used in case study, to get a better evaluation of an innovative program in higher education.

PHASE 1: SURVEY

Jaeger (1988, p. 304) stated that "a survey is a research study in which data are collected from part of a group, for the purpose of describing one or more characteristics of the whole group." An objective of the study was to use the survey method for two purposes: (1) to build a comprehensive list of pedagogical advantages and disadvantages of mobile computing use; and (2) to assess the correlation between participants' stages of technology adoption and perceptions

of pedagogical advantages and disadvantages of mobile computing use in their courses.

The study used purposive or judgemental sampling in selecting the sample on the basis of the researcher knowledge of the population, its elements, and the nature of the study aims (Babbie, 1998; Fink & Kosecoff, 1985). The reason for selecting college professors who teach courses that require students to own and use laptops at Suburban State College was because this college began requiring students to use laptop computers in some courses in fall of 2002. The respondents were selected in order to yield sufficient information regarding their perceptions (Warwick & Lininger, 1975) of, in this study, the advantages and disadvantages of mobile computing. The respondents of this survey were 30 professors from 15 departments who taught 31 courses that require its students to use wireless laptop computers, one of mobile computing devices.

EXPLANATION ABOUT THE QUESTIONNAIRE

The study employed a questionnaire to acquire information about each respondent's demographic background, history of computer use, teaching style (Grasha and Yangarber-Hicks, 2000), position in the technology adoption stage based on Apple Classroom of Tomorrow or ACOT study (Dwyer, Ringstaff, and Sandholtz, 1990), perceptions on the use of mobile computing in his or her classroom, and description of their perceptions of the advantages and disadvantages in using mobile computing.

Questions in the pedagogy and technology section were designed to uncover the respondent's teaching style and technology adoption. Question number 7 was based on the thesis of Grasha & Yangarber-Hicks (2000) correlating between teaching style and technology use in the teaching process. Question number 8 was based on Dwyer, et al. (1990) that investigates the stages of technology adoption among teachers in a longitudinal study. Question number 10 was based on Beishline & Holmes (1997) and Grasha & Yangarber-Hicks (2000) that classifies the way teachers teach in five categories.

Data collection in Phase 1

The researcher employed a written questionnaire to obtain participants' responses. It took around 30-40 minutes to fill out 18 questions on the questionnaire. Based on the research questions, the survey questionnaire acquired data on three categories of information:

1. Respondents' background, for example gender, age, number of years teaching, and number of years using computer in general. There were four questions in this part.
2. Respondents' familiarity with and knowledge about mobile computing; this section consists of seven questions about participants' courses category, participants' stages of technology adoption, participants' familiarity with mobile computing, and knowledge of computer software and hardware, number of years using mobile computing devices, and number of years using computer for courses.

3. Respondents' teaching styles; this section asked respondents to choose a teaching style from the Grasha & Yangarber-Hicks study (2000) that matched best the respondents' self-assessed teaching style. The questionnaire provided the five teaching styles with their definitions.
4. Respondents' perceptions; this section included six questions of pedagogical advantages and disadvantages of mobile computing. There was also blank space for respondents to add advantages and disadvantages that were not on the survey list.
5. Respondents' typical computer activity in 24-hour during weekdays and weekends.

Six types of questions appeared in the questionnaire. First, multiple choice plus questions that allowed a respondent to fill out the last option if the previous options do not satisfy him or her. Second, questions with yes or no answers. Third, questions with Likert Scale answer. Fourth, questions that asked respondents to rank their preference on certain statements. Fifth, questions that asked respondents to check conditions that fit with them. Sixth, open-ended questions that asked a respondent to write his or her opinion.

The draft of questionnaire was pilot tested to six college professors from January to February 2003, and the results are in Appendix 6. Based on the results of this pilot testing, the draft of survey questionnaires was revised. After this step, the president's office of the Suburban State College was contacted to get the approval for study to be started in July 2003. After a meeting with one of

the Vice Presidents and director of Information Technology Office at the college, the survey questionnaires were distributed through the campus mailing system in July 11, 2004. The college professors were selected primarily because they taught courses that required students to use wireless laptop computers. The survey was sent out to 94 professors who met this category. In the cover of the survey, there was information on how to contact the researcher if they have questions. Participants were also contacted by mailing list and e-mail to remind them about the deadline of the survey that was due on August 31, 2004. Eventually, 30 professors returned the survey or 31.9% of respondents.

Data Analysis in Phase 1

Independent variables of this study were: (1) course discipline; (2) technology adoption stage; and (3) teaching style. The dependent variable was the respondents' perception of what they understood to be the advantages and advantages of mobile computing. The researcher took systematic steps for data analysis purpose. The steps of data analysis were as follows:

1. Variables coding. Each of independent variables and dependent variable was assigned a number.
2. Response coding. Each response in the questionnaire was coded.
3. Input data into an SPSS file based on the coding. Each coded variable was paired with appropriate coded responses.
4. Correlation data analysis. The researcher employed correlation data analysis Pearson *r* and ANOVA (Analysis of Variance). For example, the research

question "Do perceptions of pedagogical advantages and disadvantages of mobile computing vary according to the college professor's teaching style?" measured the correlation coefficient *r*. The value of r was within a range of +1 (perfect positive correlation) to –1 (perfect negative correlation). A correlation coefficient of .99 suggested a positive correlation between participants' courses and their perceptions of certain pedagogical advantages and disadvantages of mobile computing.

Phase 1 provided complete list of the participants' perceptions of mobile computing grouped into two categories: pedagogical advantages and disadvantages, the correlation data between each of four independent variables, such as professors' teaching styles, professors' teaching methods, professors' stage of technology adoption, and professors' use of mobile computing in the classroom.

In addition to the contribution of the phase on survey data to the overall investigation, survey results were also used to prepare and analyze the interview and direct observation report to acquire a more comprehensive description about the participants' perceptions. For example, the degree to which a professor self-assessed teaching style matched the classroom observation was carefully monitored. Statistical outcome of the phase 1 assisted the researcher to conduct the qualitative study in phase 2. For example, interview questions were asked to probe further the participants' specified teaching style.

PHASE 2: CASE STUDY

Case study is "an idiographic examination of a single individual, group, or society" (Babbie, 1998: p. 282). In this study, case study method was employed to investigate more deeply the participants' perceptions of mobile computing, within its real-life condition and context. Yin (1994) said that this was a pertinent reason for choosing a case study method. Goodson & Mangan (1991) stated the interviews and observations provided useful context to the survey results.

Jaeger (1986) and Yin (1994) suggested that a comprehensive case study must not set up a clear boundary of the system under observation. The phenomenon under study must blend in with the real-life situation. In this study, the main research question was: "What do college professors perceive to be the pedagogical advantages and disadvantages of mobile computing in courses that require its use by students?" A real-life situation does not emphasize physical boundary that in this case is the classroom. Rather, the objective was to see the phenomenon – perceptions of mobile computing -- as the participants work and live with wireless laptop computers.

The participants of this case study were college professors at Suburban State College, a state college in northeast of the United States who voluntarily participated in the study. An opportunity to participate in the case study was announced on survey questionnaire in phase 1. The participants of survey in phase 1 who agreed to participate filled out their names, telephone numbers, and e-mail addresses in the end of survey questionnaire. They were contacted to set

up the time and place for three classroom observations and two interviews. According to Yin (1994), there are six sources of evidence in this approach: (1) documentation, (2) archival records, (3) interviews, (4) direct observations, (5) participant-observation, and (6) physical artifacts. For the purpose of this study, three sources of evidence were utilized: syllabus documentation, interviews, and direct classroom observations.

Data Collection in Phase 2

Five participants participated in all three tasks: (1) providing archival records, such as lesson plans, syllabus, and on-line correspondents that related to the courses they teach documentation; (2) two interviews, one in the beginning and one at the end of fall 2003 semester – that each will take around 45-60 minutes, and follow-up e-mail communication, in case the researcher needs to add or clarify some information; and (3) three direct classroom observations, each one in the beginning, middle, and at the end of fall 2003 semester.

The archival records in this study were the history of the wireless policy, administrative correspondents, lesson plans, syllabi, and on-line correspondents. The data were acquired from the participants, the college's Office of Information Technology, and the college's president office. The purpose of this data was to cross-check and triangulate the other data sources regarding the use of mobile computing college-wide.

Interviews were conducted at the convenience of participants and mostly done by conversation between the interviewer and the participants. In

interviewing process, the researcher used a consistent protocol. A sound and clear protocol is the major tactic in increasing the reliability of this case study (Yin, 1994). The purpose of interview was the most important one in phase 2 because the researcher acquired comprehensive qualitative data about the participants' stage of technology adoption, the participants' teaching style, and the participants' perceptions of mobile computing. The interview protocol of this study is provided in Appendix 4.

Direct observations were conducted in the classrooms when participants taught a course. Three separate class sessions of each participant were observed in the fall 2003 semester, with sessions from 1 to 3 hours duration. The purpose of the observation was to acquire information about participants' teaching methods, teaching styles, and use of mobile computing technology. There was no intervention or involvement of the researcher in the classroom activity. An observation could uncover participants' unconscious actions during their teaching sessions that did not put into the participants' consideration when they are interviewed or filling out the survey (Goodson & Mangan, 1991).

Data Analysis in Phase 2

In phase 2, the main data sources were interview transcriptions and observation reports. Another data source was archival records used for triangulation of other data sources.

Main codes for interview transcriptions are:

1. Professors' teaching methods.

2. Professors' teaching styles.
3. Professors' stages of technology adoption.
4. Professors' perceptions: pedagogical advantages and disadvantages.
5. Professors' seven aspects of post-modernism professionalism.

The participants' individual responses were analyzed using the codes. The transcripts of the interviews were produced within two weeks after the interview. Therefore, interviews were conducted with other participants while transcribing was taking place. After interviews were transcribed, a third person was assigned to check the accuracy of the transcripts and after the transcripts were checked and perfected, the interview data were checked and analyzed by using qualitative analysis.

Each participant's interview transcript was analyzed with codes in each question. The basic codes were: (1) participants' stage of technology adoption, (2) participants' degree of post-modernism professionalism, (3) participants' teaching style, and (4) participants' perception that grouped into pedagogical advantages and disadvantages. Each of these codes has one to three related questions.

After coding each response, transcription was listened to for one more time with reading the transcribed interview to check the general response. A trained person checked the coding and the transcription. Every interviewee's response on each question was considered unique. In this regard, there was a possibility that in the coding process, new data emerged from every

conversation. For example, a professor might say that he perceived wireless laptop as a good tool for helping students doing their research and completing their assignments promptly. Another professor might say that wireless laptop was a good tool for helping students working in team and communication.

This information then correlated with the classroom observation data of the professor's class.

Main codes in classroom for analyzing classroom observation reports are:

1. Professors' class time from beginning to its end.
2. Professors' activities during the class.
3. Professors' use of technology.
4. Professors' interaction with students.
5. Professors' statements during the class.

Data from classroom observations were employed to check the professors' responses in survey and interview. For example, a professor who claimed the she used personal model teaching style in the survey was confirmed in two interviews and three classroom observations. This outcome would confirm the professor's teaching style for further analysis.

Interviews and classroom observations were grouped into similar categories depending on whether participants perceive specific advantages or disadvantages. Their responses were counted together under the topic of existing participants' profiles for technology adoption stage, teaching style, and post-modernism professionalism criteria. The result of this phase was a detailed

list of pedagogical advantages and disadvantages of mobile computing with its relation to participants' profiles.

Mobile computing facilitates teachers to attain "postmodernism professionalism" based on seven principles presented by Hargreaves & Goodson (1996) and Fisher (1999):

1. Opportunities and responsibility to exercise discretionary judgement. For example: the faculty has willingness to share and discuss grading criteria with students and to explain the reasons of those criteria thoroughly.
2. Opportunities and expectations to engage with moral and social purposes. For example: the faculty keeps his or her mind opened to everlasting discussions on the impacts of teaching on both students and the society.
3. Commitment to working collegially within collaborative cultures. For example: the faculty involves in the Internet mailing list(s) or, if possible, conducts research project(s) with other faculty – inside or outside of one's campus -- that would influence his or her practice in the future.
4. Occupational heteronomy rather than self-protective autonomy. For example: the faculty shares their experience, skill, and knowledge with other faculty and is ready to admit his or her limitations in certain field(s) while maintaining his or her expertise in teaching and learning issues.
5. Commitment to active care and not just anodyne service for students. For example: the faculty knows his or her students' psychological conditions,

expresses sincere attention to their difficulties in learning, and helps them to solve those problems.

6. A self-directed search and struggle for continuous learning. For example: the faculty uses his or her ample time for improving teaching skill and knowledge and keeps monitoring new research findings to adjust his or her daily teaching practice.
7. The creation and recognition of high task complexity. For example: the faculty gives students assignments that represent the real world and encourages them to use creative approaches and be ready to encounter dilemmas in those assignments.

Interview data were used to assess the seven professionalism values on five professors who participated in case study. Based on grounded theory approach, the professors' statements were selected and put into seven categories, each representing one value of Hargreaves & Goodson's post-modernism professionalism. The qualitative analysis software N-Vivo was used to locate the statements that matched with or close to the values.

The combination of survey and case study in this study was expected to produce a comprehensive college professors' perceptions of mobile computing. The survey result was analyzed through four null hypotheses that consecutively look into the relationship between independent and dependent variables. The analysis of variance (ANOVA) provided *r* score or degree of correlation of independent variables, such as college professors' teaching methods, teaching

styles, technology adoption stages, and percentage of class time for mobile computing use, with dependent variables, such as advantages and disadvantages of mobile computing.

The case study followed the survey and looked at the variables more intensively, such as professors' teaching styles. Were they doing what they claimed to be in the survey? Some professors' claims were consistent from survey to case study, some did not. The discrepancies between professors' claim in the survey and professors' actual activities when they were observed in the classroom and professors' responses in interviews were analyzed and discussed.

In addition to variables testing and clarification, the study was looking into the professors' perceptions on post-modernism professionalism values to see whether they have those values in their statements in interviews. This data would enrich the study with information on the professors' expressions that were matched with seven values of the professionalism values.

CHAPTER 4: RESEARCH FINDINGS

THE RESEARCH SETTING

Suburban State College is located around 20 miles west of a major metropolitan area in northeastern of the United States. The college was founded in 1839 and its web site claims that Suburban State College was the first state-supported institution of public higher education in the United States for the training of teachers. The college campus is located on a 73-acre hilly campus beside a state highway in a large suburban town.

According to the Office of Academic Affairs of Suburban State College, there were about 4,600 matriculated undergraduate and graduate students in fall semester 2003. This student population was divided into two groups: about 3,700 students or 80% of the population were enrolled in 22 undergraduate programs, and 900 students were enrolled in graduate programs.

At the time of this study, Suburban State College offered three bachelor programs: (1) Bachelor of Arts, (2) Bachelor of Science, and (3) Bachelor of Science in Education. Bachelor of Arts had 11 majors, from art to sociology. Bachelor of Science had 10 majors, from biology to nursing. Bachelor of Science in Education had two majors: early childhood education and elementary education. In addition to those majors, undergraduate students could also take a minor from a pool of 37 fields, from American studies to writing. The college had 18 academic departments that were responsible for conducting the related academic activities in those major and minor bachelor programs.

WIRELESS LAPTOP PROJECT

During the research, one of the college's goals was the infusion of information technology throughout the curriculum. To help achieve this goal, the college began implementing a wireless laptop project in fall 1998. In May 2001, the college president announced a technology infusion initiative that would further integrate new instructional technologies into the curriculum. The initiative pushed the wireless laptop project forward with a definite target: all undergraduate students will own wireless laptop computers by the year 2005. Consequently, the wireless laptop project entered an important stage in fall 2002 when the college required all new freshmen and full-time transfer students to own laptop computers with wireless capability.

To implement wireless laptop project, the college had been developing a wireless infrastructure enabling faculty, staff, and students to access the campus network and the Internet from all of the buildings on-campus through approximately 140 wireless access points. The wireless access points were Enterasys Roamabout R2 Aps employing protocol 802.11b. These access points link to Enterasys Matrix E1 network switches at various locations throughout campus. Furthermore, the wireless signals are fed back via Gigabit modem to the core router Enterasys ER 16.

In fall 2003, the college recommended Dell Latitude D600 and Gateway 450 laptop computers because the vendors of these two computers agreed to sell the computers with a discount, so each wireless laptop computer costs $

1,309 plus tax. In addition, the vendors agreed to provide on-campus support services and four years on-campus warranty. Every student, however, may purchase his or her own laptop computer as long as the computer meets the minimum specifications, such as Windows 2000 operating system, Pentium III/600 MHz processor, 128 megabytes random access memory (RAM), 2 gigabytes hard drive, Ethernet card 10/100, wireless card 802.11b, CD-ROM or CD RW drive, 3.5 floppy disk drive, and software. The wireless system did not work with Macintosh operating system.

In several cases, students who purchased their own laptop with Centrino processor and Windows XP operating system had problems when they were connecting their laptops to the campus wireless network. An Information Technology staff explained that those laptop computers will have connection glitches when they are operating in one classroom at the same time because these computers communicate with each other as opposed to the wireless access points. In this case, students must go to IT Help desk to get the right configuration. The IT staff then helped students to set up their laptops so it would connect properly with the campus wireless system.

COURSES WITH WIRELESS LAPTOP REQUIREMENT

In conjunction with the wireless laptop project, the college has gradually increased the number of courses that employ this technology in their curriculum. According to the Office of Academic Affairs, the college offered 78 "wireless laptop courses" in fall semester of 2003 for a total of 151 individual class

sections. Figure 2 shows the increase in courses requiring students to own wireless laptops. The college administration used the phrase "wireless laptop course" for a course that requires students to bring their wireless laptop computers to the class. See Glossary for full description of the phrase. However, because this phrase implies a course that teaches students to use wireless laptops, or a course that was conducted solely through their laptop computers, which was not the case, this study used the phrase "course with wireless laptop requirement" instead.

The college administration reported that 2,040 students took these courses during fall semester of 2003. Around 1,850 students or 90% of students who took these courses owned wireless laptop computers. Seventy-five different faculty members taught these courses. Those faculty members either bought or borrowed wireless laptop computers from the college. In fall 1998, when the college first offered this type of course, there were only four courses. Figure 2 shows the growth of courses with wireless laptop requirement during 1998-2003 period.

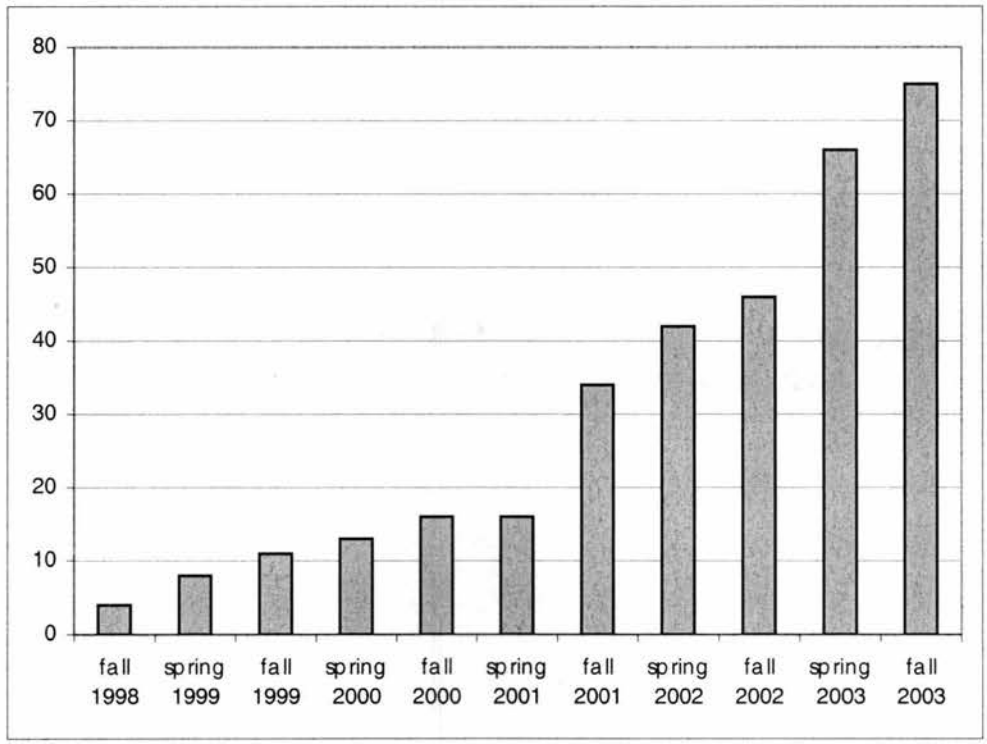


Figure 2. Courses with wireless laptop requirement at Suburban State College.

In the course with wireless laptop requirement, each professor has a capability to conduct the class either synchronously or asynchronously using virtual classroom on a Blackboard.com web site. These web sites typically contained a course syllabus, class presentations in Word or Power Point file formats, students' web sites, Internet links to web sites that are related to the course, on-line quizzes, teams' folders, and discussion boards. Some sessions in the courses were conducted synchronously that enabled a real-time interaction between students and professors. On some occasions, students and professors sometimes left their laptop computers at home when the professor would conduct a lecture for the whole class session. When the students brought their laptop to

the class, they usually used laptop for opening course web sites on Blackboard.com, checking web sites as requested by the professors, giving presentation with Microsoft Power Point, using spreadsheet like Microsoft Excel, writing with Microsoft Word, or conducting a virtual team meeting with chat room. There were also times during class meetings when students did not use their laptops.

WORM ATTACK IN THE FIRST TWO WEEKS OF FALL 2003

Despite the best efforts of the Information Technology staff, the college computer network did not operate properly at the beginning of this research in the first two weeks of fall 2003. The most visible problem was difficulty to get Internet access or unreliable connection from wireless laptop computers. Three professors reported that there was a virus problem in the college server. An Information Technology staff confirmed this and identified "*W32.Welchia.Worm*" as the culprit. Symantec Corp. (2003) reported that the worm was discovered on August 18, 2003. It was attacking Windows 2000, Windows XP, and Windows NT, by sending an ICMP echo request, or PING, which would increase ICMP traffic. In Suburban State College case, the Welchia worm launched a command of "denial of service attack," preventing the infected computer from going on-line or connecting to a local area network.

The student newspaper wrote that the college computer technicians cleaned out the system the week before students returned for fall 2003 semester. Nevertheless, the outbreak of computer worms happened again when the

returning students brought their laptops that had the worm to the campus. The IT staff explained that some of the returning students had not installed the appropriate Windows anti-worm patch when they logged on to campus network, and the entire network became infected.

The worm or virus attack influenced some courses, especially those that required students to use wireless laptop computers. Five professors who participated in the phase two of the study complained that the virus attack has forced them to teach without asking students to do on-line research in the class because the students could not use their wireless laptop computers. The professors then taught the class using Power point, overhead transparencies and paper, or 35 mm positive slides presentations. They made some adjustments in their syllabi and class schedule, such as postponed the sessions that needed students to use wireless laptop computers and moved up the lecture sessions that did not need students to employ their laptop computers. The survey questionnaire for this study was administered before the worm incident occurred.

TWO PHASES OF THE STUDY

The main research question of this study was "What do participating college professors perceive to be the pedagogical advantages and disadvantages of mobile computing in courses that require its use by students?" The study employed both quantitative and qualitative approaches and was conducted in two sequential phases. Phase one was a quantitative study in the form of survey that was initially distributed in July, 2003, and results were

collected through November, 2003. Phase two was a qualitative study in the form of classroom observations and interviews of five full-time professors. The case study was conducted during fall 2003 semester, started in September, 2003, and ended in December, 2003. The selection of the participants in phase two was based in part on the survey results. One of the survey questions asked if respondents would like to participate in phase two of the study. If they agreed to participate, it meant that they would need to be available for two interviews and three classroom observations. Through this process, five faculty agreed to participate in the phase two case study.

GUIDE TO THE RESEARCH FINDINGS

The results of phase one of the study are presented in Sections 1.1, 1.2, and 1.3 of this chapter. The results of phase two are reported in Section 2.1.

Section 1.1 presents demographic data of the respondents including their age and gender. The report also presents: (1) how long the respondents had been using mobile computer, including laptop computers during the timeframe of the study, (2) how long the respondents had been teaching, and (3) academic departments where the respondents work.

Section 1.2 reports the analysis of the survey results using SPSS statistical tool to calculate frequency and descriptive statistics of five independent variables: (1) teaching methods, (2) teaching styles, (3) technology adoption stage, (4) mobile computing use in the classroom, and (5) the pattern of computer use outside of the classroom that includes on-campus, off-campus,

weekdays, and weekends.

Section 1.3 reports the analysis of the survey results using SPSS statistical tool to test the four hypotheses of this study. The four hypotheses were:

Null hypothesis 1: Respondents' teaching methods did not correlate with their perceptions on the advantages and disadvantages of mobile computing.

Null hypothesis 2: Respondents' teaching styles did not correlate with their perceptions on the advantages and disadvantages of mobile computing.

Null hypothesis 3: Respondents' stages of technology adoption did not correlate with their perceptions on the advantages and disadvantages of mobile computing.

Null hypothesis 4: Respondents' mobile computer use did not correlate with their perceptions on the advantages and disadvantages of mobile computing.

The outcomes of the correlation testing are presented and explained in Section 1.3, especially the significant and non-significant correlations between the independent variables and dependent variables with the advantages and disadvantages of mobile computing.

Section 2.1 presents the results of phase two of the study as case studies of five professors who volunteered to be participants. The case study method was used to describe the professors' perception on mobile computing through classroom observations and interviews. Five professors identified as Prof. A, Prof. B, Prof. C, Prof. D, and Prof. E made time for two interviews and allowed

three classroom observations in fall 2003 semester. The professors also provided the syllabi of their courses. Table 5 shows the organization of result data presentation of this study.

Table 5. Organization of data presentation

Phase 1	Section 1.1: Demographic data Gender and age Computer use Teaching experience Departments Section 1.2: Frequency data of independent and dependent variables Teaching methods Teaching styles Technology adoption stage Average percentage of classroom time using mobile computer Advantages and disadvantages of mobile computing Section 1.3: Testing the hypotheses Four hypotheses to test the correlations between independent variables and dependent variables. The dependent variables were advantages and disadvantages of mobile computing.
Phase 2	Section 2.1: Case study of five professors - Prof. A) - Prof. B) - Prof. C) - Prof. D) - Prof. E) In this phase, four data sources were analyzed: (1) The participants' responses in the survey, (2) classroom observations, (3) interviews, (4) syllabus. The data were compared with dependent variables of advantages, disadvantages, and their opinions relating to post-modernism professionalism values.

PHASE 1: THE SURVEY

The survey questionnaire acquired five types of information relating to the research questions:

1. Respondents' background, for example gender, age, number of years teaching, and number of years using computers in general.
2. Respondents' familiarity with and knowledge about mobile computing, including participants' self-assessment of their position on a scale of five stages of technology adoption based on Apple Classroom of Tomorrow or ACOT (Dwyer, Ringstaff, & Sandholtz, 1999), the number of years using mobile computing devices, and their mobile computer use in the classroom.
3. Respondents' teaching styles, including five teaching styles that were chosen from Grasha & Yangarber-Hicks study (2000) to provide a continuum of teaching styles from which the respondents could select the one that best matched their own.
4. Respondents' perceptions, including their perception on pedagogical advantages and disadvantages of mobile computing.
5. Respondents' typical computer activity in 24-hours during weekdays and weekends.

Thirty respondents, or 32% of 94 faculty members who teach wireless courses in the college, completed and returned the survey. The list of the 94

faculty members to whom the survey was distributed was acquired from the college's Office of Academic Affairs and the Department of Academic Technology Training and Support.

Section 1.1: Demographic data of the respondents

Gender and Age

The majority of the survey respondents were female. There were 22 female professors or 73% of the total respondents. Twelve of them or 40% of respondents were in the 51 years to 60 years old age group. Figures 3 and 4 show the respondents' gender and age group.

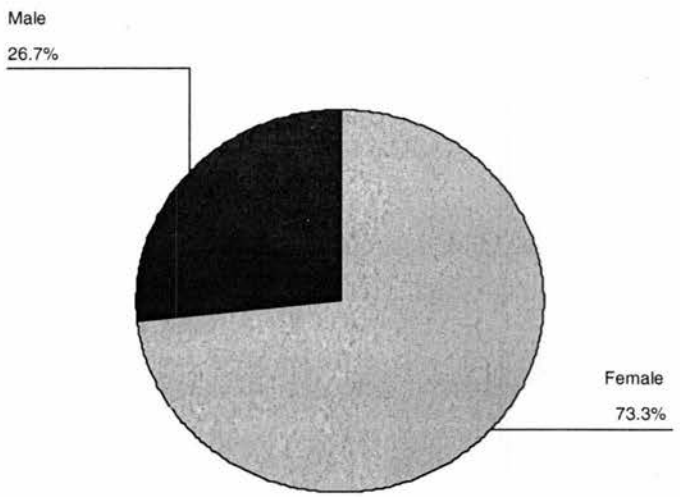


Figure 3. Gender of respondents is 8 males and 22 females

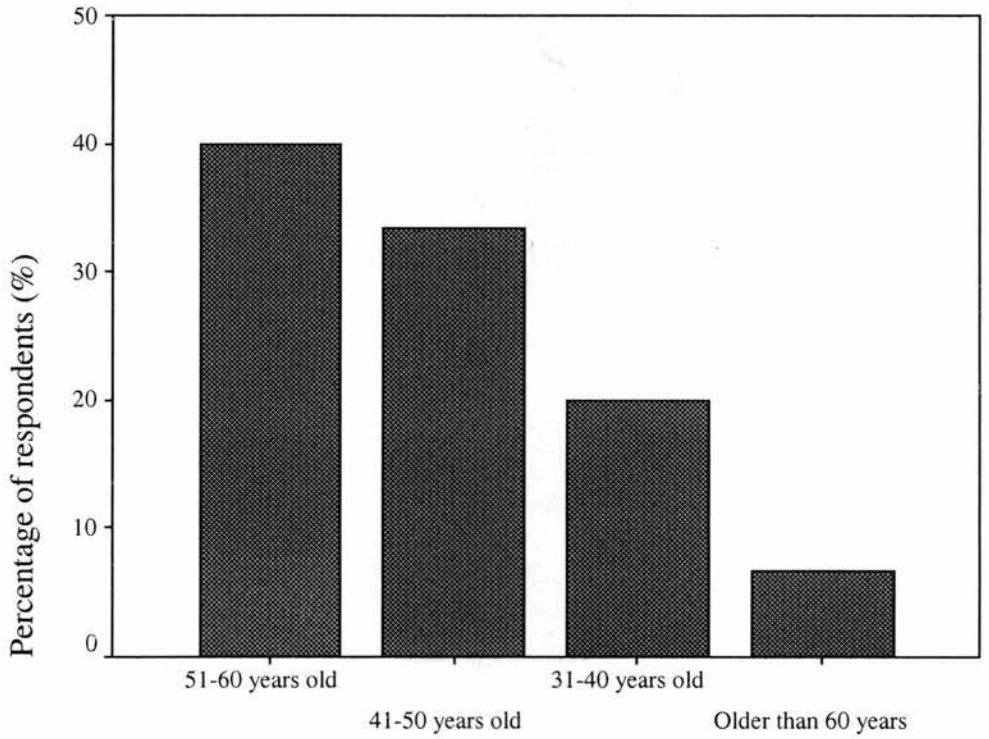


Figure 4. Age group of respondents

Computer use

Five respondents or 16.7% of total respondents had been using laptop computer for 15 months. This was the biggest single group in the survey. Seven respondents or 23.3% of total respondents reported using laptop computers between 1 month and 12 months. Four respondents or 13.3% had been using laptop computer for more than 24 months. The largest group with fourteen respondents or 46.7% of total respondents reported using laptop computer between 12 months and 24 months. Figure 5 shows the duration the respondents had been using laptop computer.

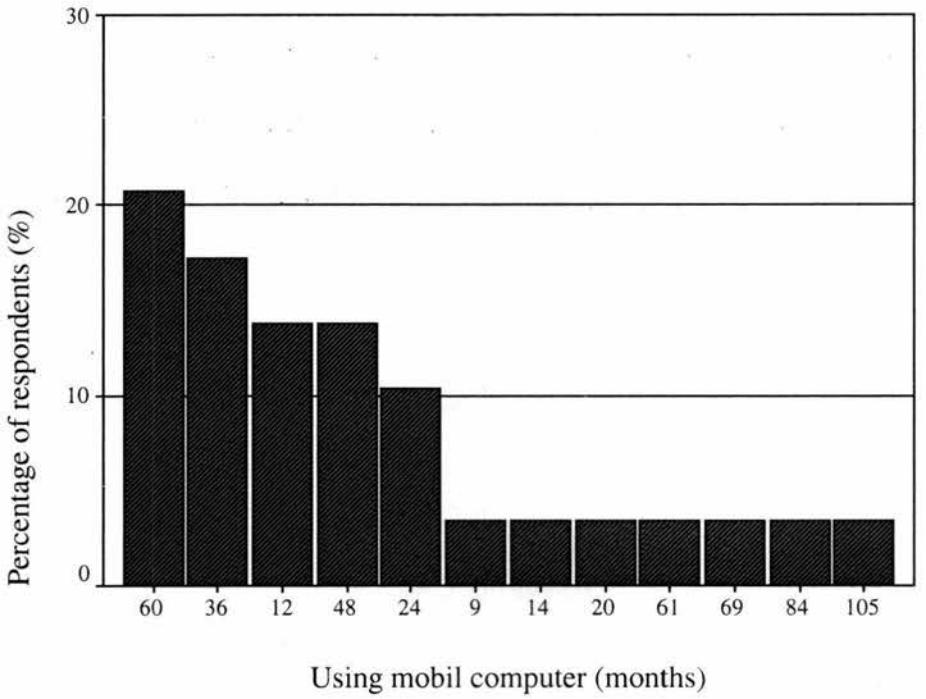


Figure 5. Respondents' laptop computer use

Teaching experience

In terms of teaching experience, there were five groups of respondents. Eleven respondents, or 36.7% of the total, had been teaching for more than 21 years. Ten respondents, or 33.3%, had been teaching for between 11 years and 15 years. Five respondents, or 16.7%, had been teaching for between 16 years and 20 years. Only four respondents, or 13.3%, had been teaching for less than 10 years. Figure 6 shows the respondents' teaching experience.

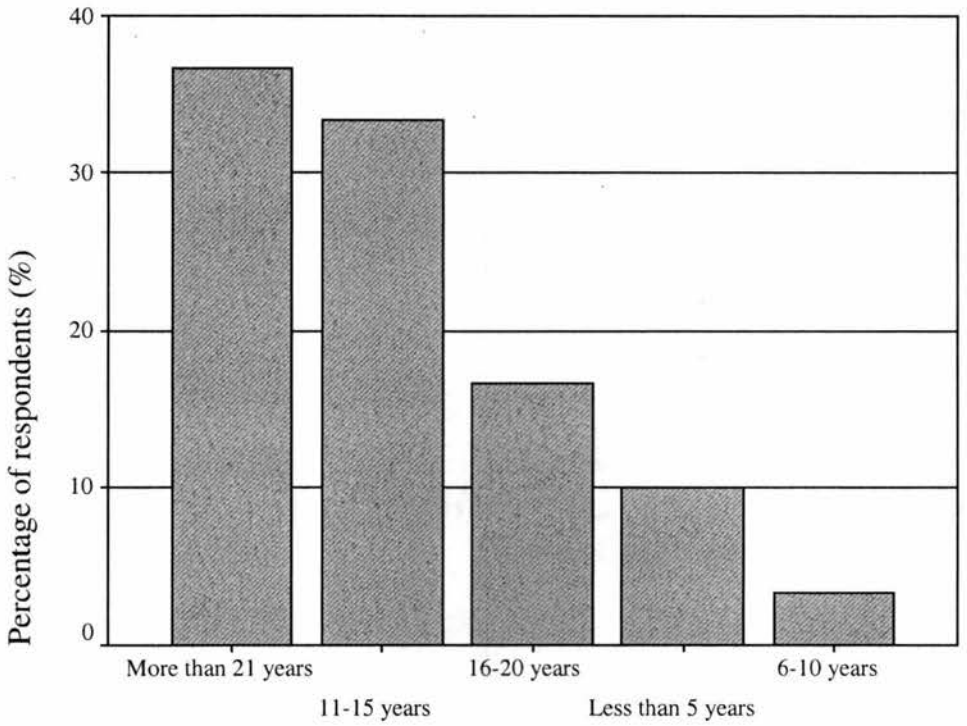


Figure 6. Respondents' teaching experience

Departments

At the time of this study, Suburban State College had 18 academic departments. The respondents of the survey came from 15 departments. None of the faculty from Government, Physics and Earth Sciences, and Sociology departments returned the survey. Six respondents were from English department, four from the Biology department, three from Consumer Sciences, and three from Economics and Business Administration department. Table 6 shows the respondents' academic departments.

Table 6. The respondents' departments based on the courses they taught

Department	Respondent(s)
Art and Music	1
Biology	4
Chemistry and Food Science	2
Communication Arts	1
Computer Science	1
Consumer Sciences	3
Economics and Business Administration	3
Education	2
English	6
Geography	1
History	1
Mathematics	1
Modern Languages	1
Nursing	2
Psychology and Philosophy	1
Total respondents (N)	30

Section 1.2: Frequency and Descriptive Statistics of respondents' independent variables and dependent variables

There were five independent variables: (1) teaching methods, (2) teaching styles, (3) technology adoption stage, (4) mobile computing use in the classroom, and (5) pattern of computer use outside of the classroom. Frequency data of two dependent variables, advantages and disadvantages, is also presented in Section 1.2 without analyzing its correlation with the independent variables. The correlation analysis is presented in Section 1.3, as part of the report on testing the hypotheses. Table 7 shows the organization of survey results in Section 1.2.

Table 7. The organization of survey results in Section 1.2

Phase 1 computer	**Section 1.2.1**: Independent variables -Teaching methods -Teaching styles -Technology adoption stage -Average percentage of classroom time using mobile ***Section 1.2.1.1***: Descriptive data -Mobile computing most helpful in certain activities -Pattern of computer use: weekly off-line and on-line **Section 1.2.2**: Dependent variables -Advantages of mobile computing -Disadvantages of mobile computing **Section 1.2.3**: Post-modernism professionalism -Pattern of computer use: weekdays and weekends

Section 1.2.1: Independent Variables

Teaching Method

When selecting their self-assessed description of their preferred teaching methods, nine respondents or 30% of all respondents chose "lecture" as their favorite method. The next favorite teaching method was "students working on projects," chosen by seven respondents or 23.3%. Another seven respondents or 23.3% also chose a "combination of some or all of the five teaching methods." Figure 7 shows the respondents' teaching methods.

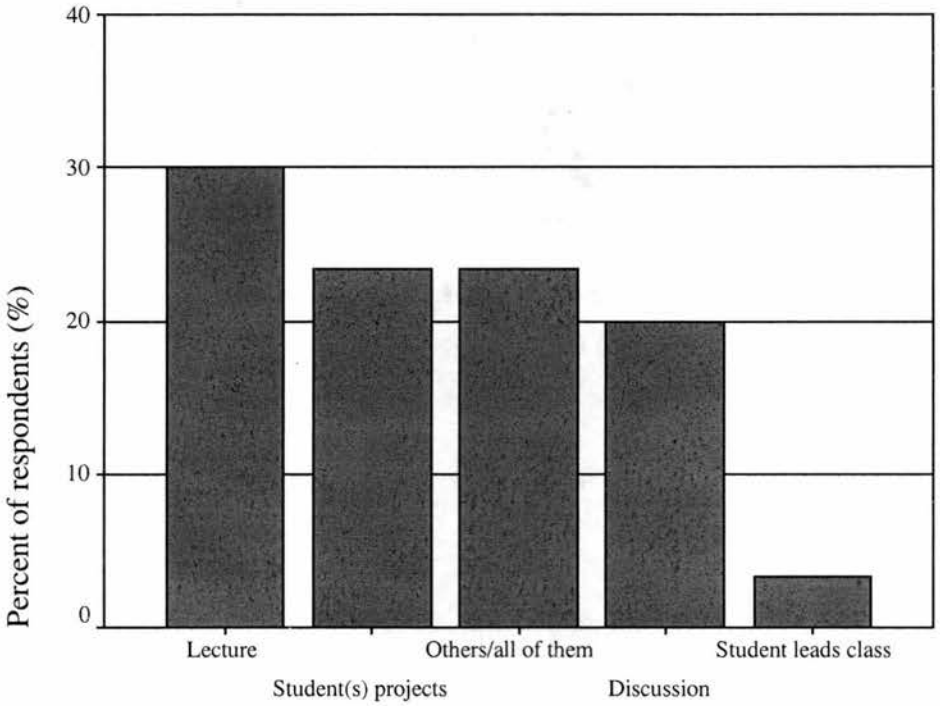


Figure 7. Respondents' teaching methods

Teaching Style

Respondents were asked to rank from 1 to 5 on a list of five teaching styles, where score 1 represented "least like me" value and 5 represented "most like me" value. Scores above 3.00 or the median score between 1 and 5 was considered representing "more like me" value because the score was closer to 5 that represented "most like me" value.

Based on Grasha's teaching style category, the survey provided five teaching styles from which to choose. Respondents made self-assessment of their teaching styles and then ranked each style. "*Expert*" style, in this study was given code EXPERT, was described as "I strive to maintain status as an expert among students by displaying detailed knowledge and by challenging students to

enhance their competence. I like students who are well prepared." "*Personal Model*" style or PERSONAL was "I believe in "*teaching by personal example.*" I oversee, guide, and direct by showing how to do things and encourage students to observe and then to emulate my approach." "*Delegator*" style or CONSULT was "I encourage students to become self-directed, self-initiating learners. The students work independently on projects or part of teams. I am available as a consultant and resource person." "*Formal Authority*" style or RULES was "I provide feedback, establish learning goals and rules of conduct for students. I describe the acceptable ways to do things and provide students with the structure they need to learn." "*Facilitator*" style or SUPPORT was "I emphasize the personal nature of teacher-student interactions. I work with students on projects in a consultative fashion and tries to provide as much direction and support as possible."

The survey results showed that respondents rated both "*Formal Authority*" and "*Delegator*" with mean score 3.43. Respondents were also rated "*Facilitator*" style with mean score 3.05. It meant that respondents considered the three teaching styles as "more like their own." Two other teaching styles, "*Expert*" and "*Personal Model*" were rated below 3.00, which meant that the respondents considered the two teaching styles as "less like their own." Figure 8 shows respondents' rating of five teaching styles.

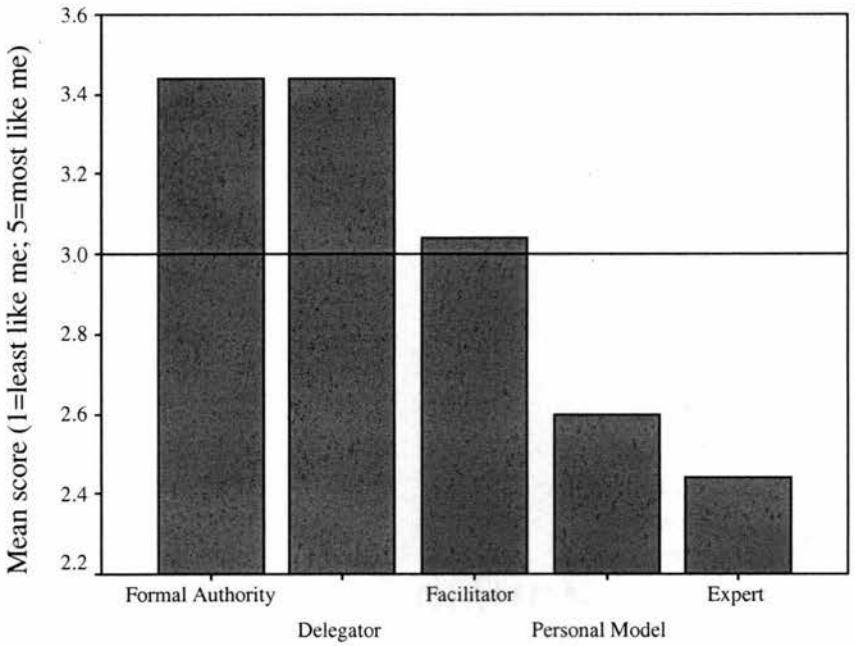


Figure 8. Respondents' rating the teaching styles that were most or least like them (30 respondents rated five teaching styles in order from 1 to 5)

Technology Adoption Stage

The survey asked the respondents to rate their degree of technology adoption in an order from 1 to 5, where 1 represents "least like me" value and 5 represents "most like me" value. Scores below 3.00 or the median score between 1 and 5 was considered representing "more like me" value because this score was closer to 5 or "most like me" value.

Using Apple Classroom of Tomorrow (ACOT) stages of technology adoption, the survey showed that respondents rated above 3.00 for two stages: "*Adoption*" and "*Adaptation.*" "*Adaptation*" stage in the survey was represented by a statement *"integrate new technology into traditional classroom practice."*

"*Adoption*" stage in the survey was represented by a statement "*use new technology to support traditional instruction.*" The mean rate for "*Adaptation*" stage was 3.75 and "*Adoption*" was 3.65. It meant that respondents considered themselves in the third and second stage of ACOT study.

The other three stages that were rated below 3.00 were "*Invention*" stage or "discover new uses of technology tools," followed by "*Entry*" stage or "learn the basics of using technology," and "*Appropriation*" stage or "focus on cooperative, project-based and inter-disciplinary work." It meant that respondents did not consider the three stages as where they were in the technology adoption stage. Figure 9 shows respondents' rating of technology adoption stage.

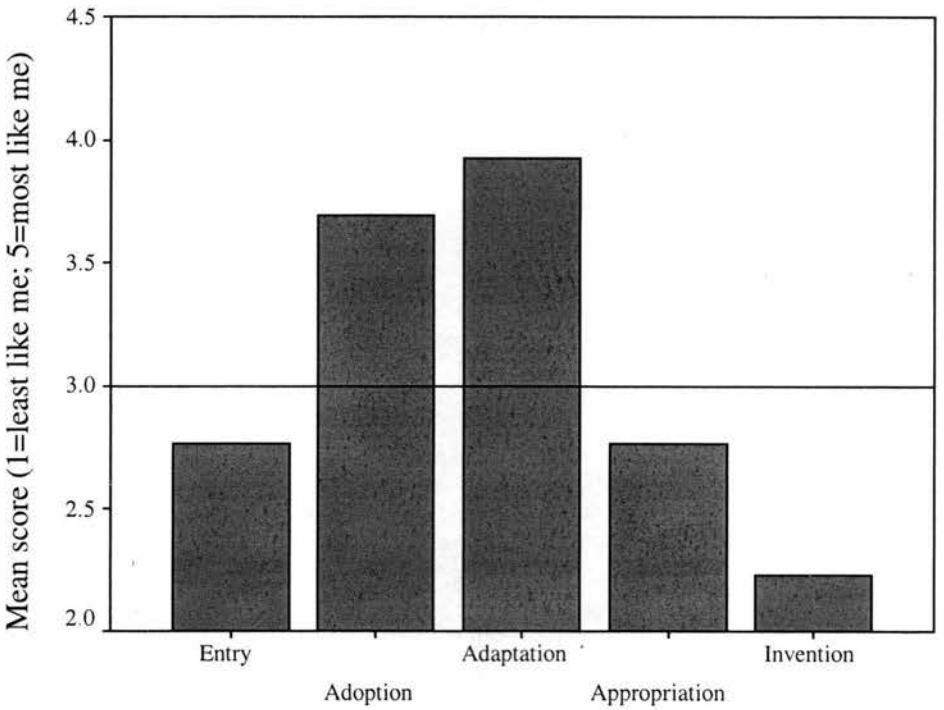


Figure 9. Respondents' rating the adoption technology stages that "most or least like me" (30 respondents rated five technology adoption stage in order from 1 to 5).

Average percentage of classroom time using mobile computer

The survey indicated the respondents' mobile computer use in their classrooms. The percentage was the portion of the class time when the class used laptop computers or other mobile computing devices. Fourteen respondents or 46.7% of all respondents chose 6%-25% of class time for mobile computing. Table 8 and Figure 10 show the frequency distribution of respondents' mobile computer use in their classrooms.

Table 8. The frequency table of mobile computer use in respondents' classroom

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 5%	2	6.67	6.67	6.67
	6%-25%	14	46.67	46.67	53.33
	26%-50%	9	30.00	30.00	83.33
	51%-75%	3	10.00	10.00	93.33
	more than 76%	2	6.67	6.67	100
	Total	30	100	100	

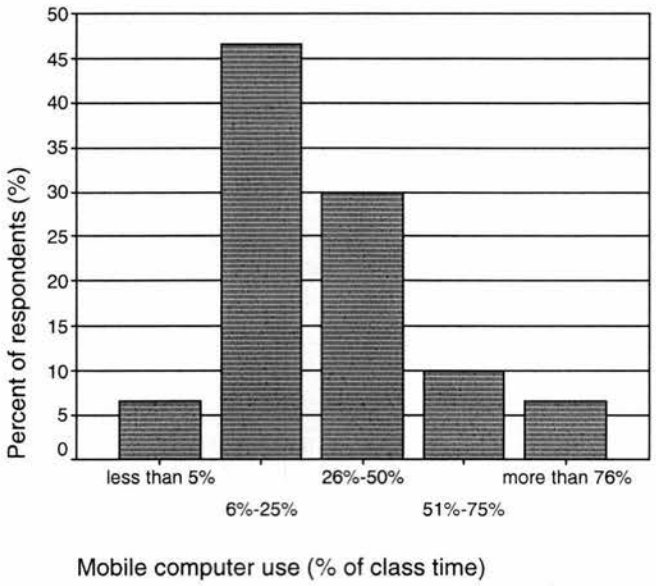


Figure 10. Respondents use of mobile computing in the classroom.

Section 1.2.1.1: Descriptive data

Mobile computing is most helpful in certain activities

Respondents were asked to rate 15 computer activities on which they considered mobile computing helpful or not helpful. The survey questionnaire asked the respondents to rate their preference in a Likert scale from 1 to 4 on a list of activities, where 1 represents "not helpful" value and 4 represents "most helpful" value. The reference line was 2.5 because it was the median score between 1 and 4. Therefore, mean score below 2.5 was considered "not helpful."

The statistical analysis showed that PRESENT or "presentation" got the highest mean score 3.7, which was closest to "mostly helpful" value. EMAIL or "e-mail" was the next highest mean score with 3.4. The next two activities were Internet research and writing syllabus and handouts for students. Figure 11 shows the activities where mobile computing was considered helpful by respondents.

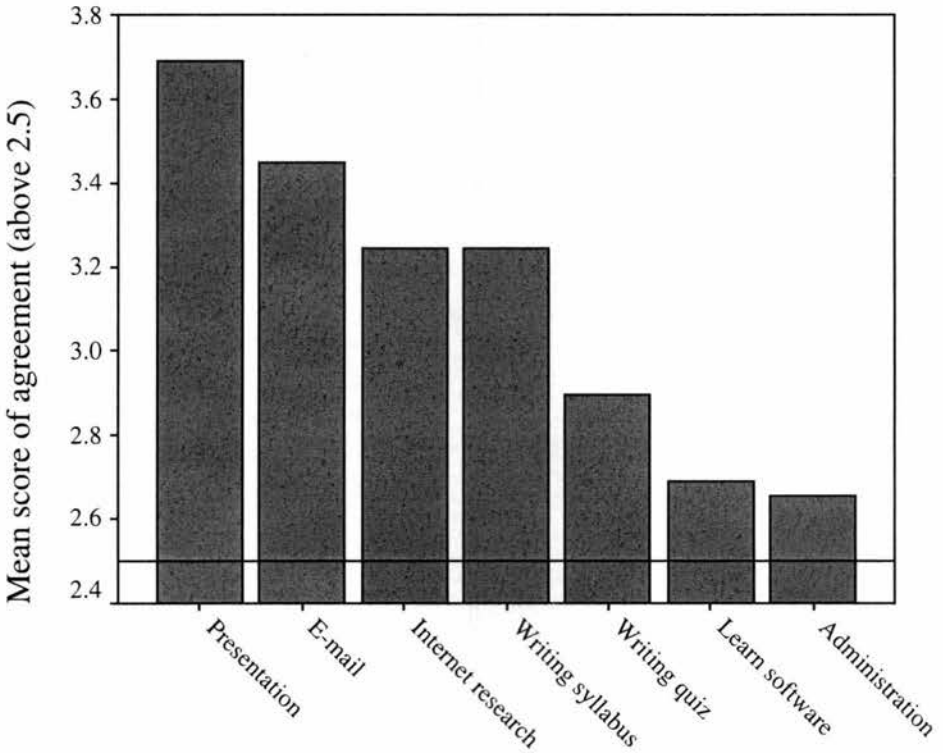


Figure 11. Respondents' perceptions of the helpfulness of specified mobile computing activities

Three activities where mobile computing was considered least helpful were GAMES or "playing games," CHATDIS or "chatroom/on-line discussion," and GRADING or "grading and student evaluation" whose mean scores were 1.3, 1.8, and 2.3 respectively. Figure 12 shows the activities where mobile computing was considered not helpful by respondents.

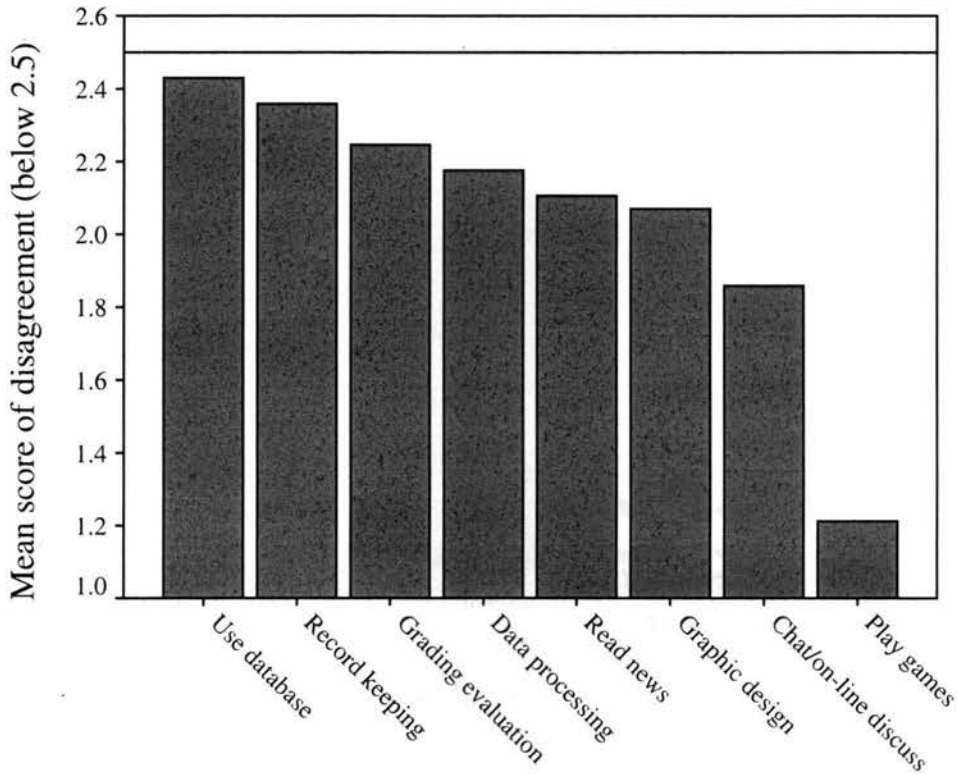
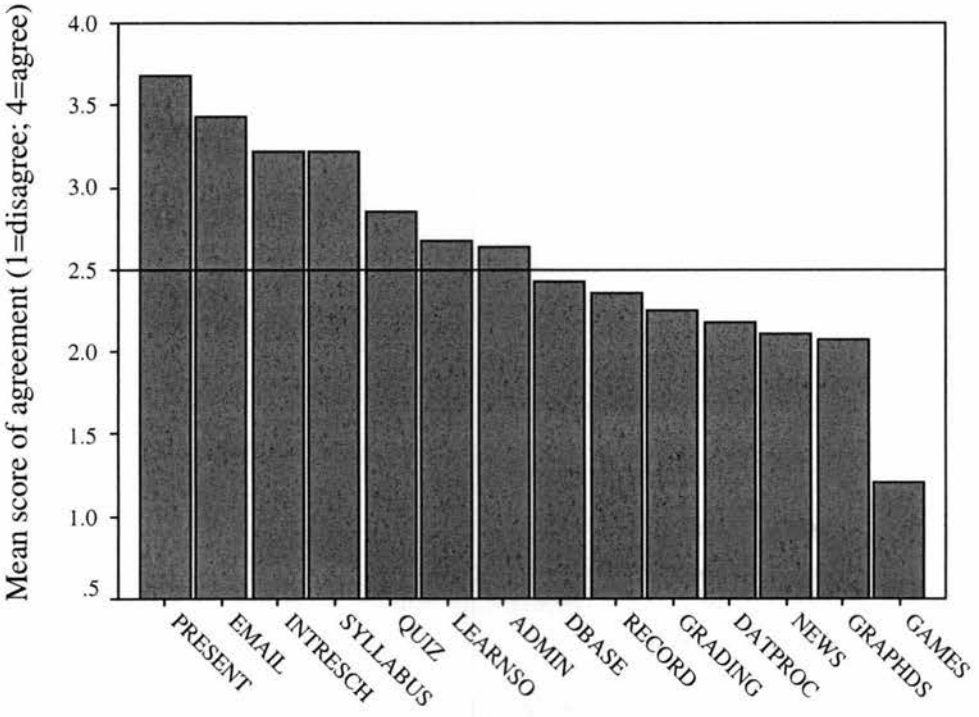


Figure 12. Respondents perceived mobile computer was not helpful in these activities

Figure 13 combines two figures to show both helpful and not helpful considerations of mobile computing in all activities.



Legend

PRESENT = Presentation
INTRESCH = Internet research
SYLLABUS = Handout and syllabus writing
QUIZ = Writing quiz, test, and assignment
GRADING = Grading and student evaluation
EMAIL = E-mail
CHATDIS = Chatroom or on-line discussions
ADMIN = Administration, letters, and memos
NEWS = Reading news
DATPROC = Data processing
GRAPHDS = Graphic design
RECORD = Record keeping
GAMES = Playing games
LEARNSO = Learning how to use software applications
DBASE = Using databases

Figure 13. Perceived degree of helpfulness of mobile computing

The next section reports activities that respondents added that were not included on the list. Two respondents added that mobile computing was most helpful in designing course web site on Blackboard.com, two other respondents reported that mobile computing was also helpful in creative writing activities, and another respondent mentioned that mobile computing was helpful in graphic illustration for algebraic simplification and analysis.

Weekly off-line computer activities

The survey also asked how the respondents spent their time in an estimated average week with mobile computing devices outside of the classroom, off-line or not connected to the Internet. On average, the respondents reported spending 4.5 hours per week for "*grading students' works.*" The next three most common activities were "*preparing presentation*" for 3 hours/week, "*writing lesson plans*" for 2.5 hours/week, and "*writing handouts*" for 2.5 hours/week. Figure 14 shows the respondents' off-line activities with their mobile computers. Five respondents presented comments about their off-line activities. Those comments are presented in Table 9.

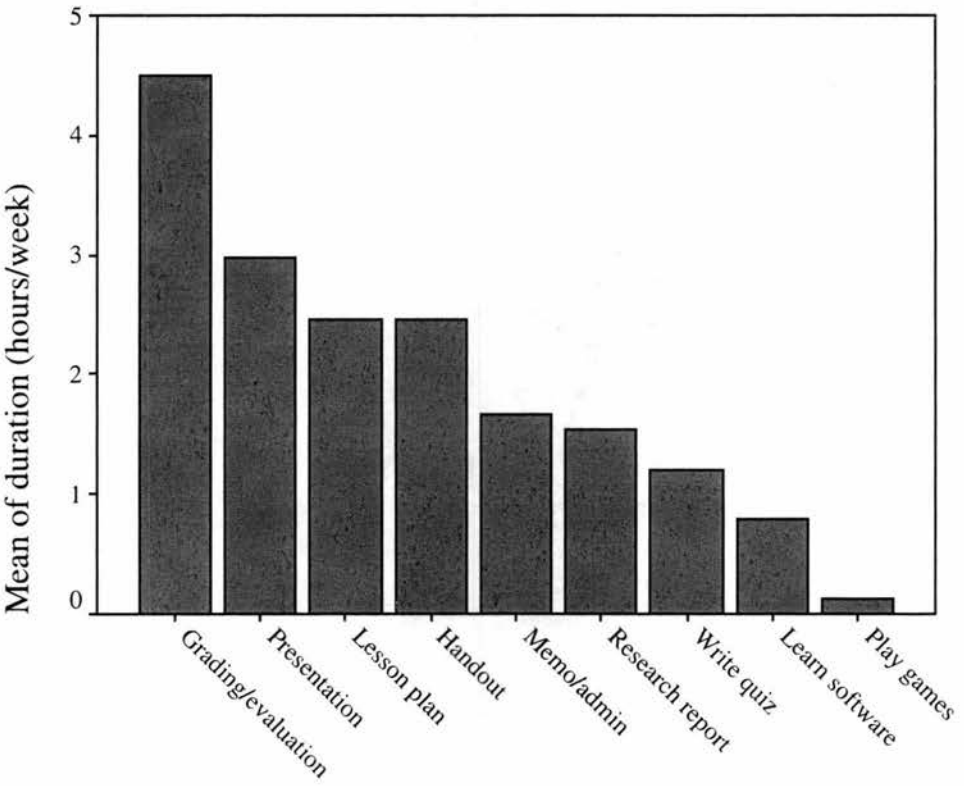


Figure 14. The respondents' off-line mobile computer activities outside the classroom in an average week.

Table 9. Several respondents commented on the survey regarding off-line activities with mobile computers.

Off-line activities in one week
"4 hours (entire [*hours working for course site on*] Suburban State College Blackboard.com site)"
"creative writing [*preparing course materials*]"
"4 hours (graphing; algebraic simplification&analysis)"
"creative writing [*course materials*]"
"4 hours (course web page design)"

Weekly on-line computer activities

The survey asked how the respondents spent their time in an estimated average week with mobile computing devices outside of the classroom, on-line or

connected to the Internet? The survey result revealed that respondents on average spent 5.2 hours per week for "*e-mail.*" The next three most common activities were "*Internet research*" for three hours/week, "*updating personal-professional web site*" for one hour/week, and "*on-line/reading news*" for one hour/week. Figure 15 shows the respondents' on-line activities. Table 10 shows the respondents' comments on their on-line activities.

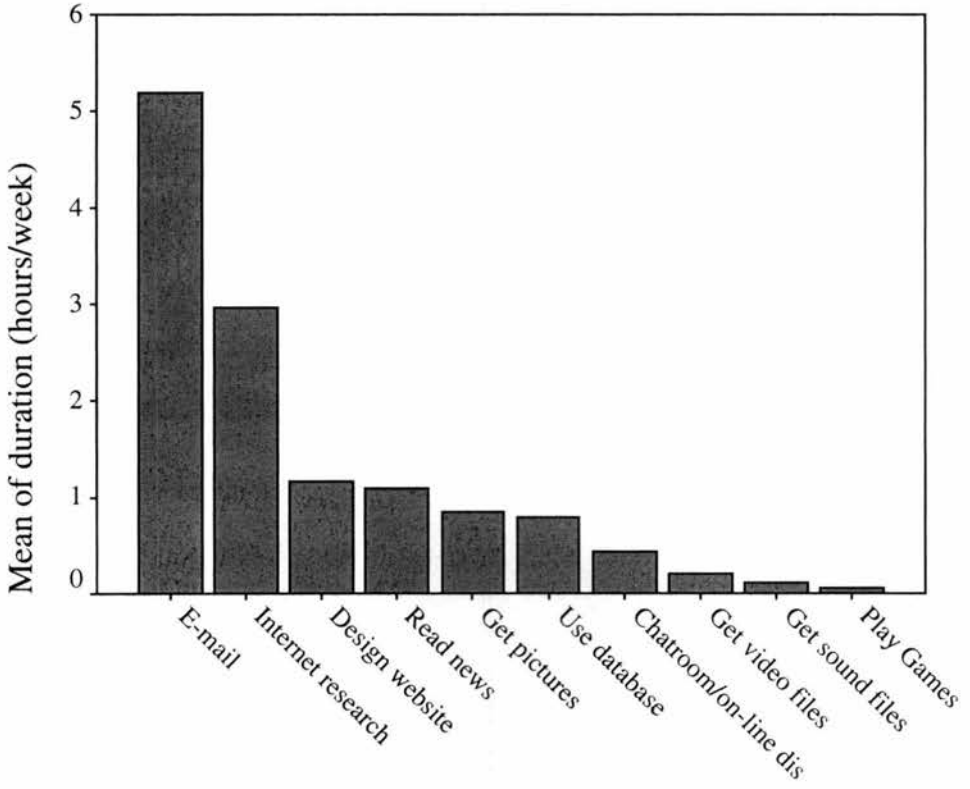


Figure 15. The respondents' on-line mobile computer activities in an average week (approximately 11 hours per week).

Table 10. Several respondents commented on the survey regarding on-line activities with mobile computers

On-line activities in one week
"I use my regular computers for these activities--probably 20+ hrs per week"
"Attend [*and teach*] classes a semester; 3-6 hours per semester"
"I use the computer for all these tasks [*e-mail, Internet research, reading news, chatroom/on-line discussion, getting pictures/images, getting sound files, getting video files, updating personal/professional web site, using databases, playing games*]. Th
"All work related to classes combined. Average/week across semester"
"1 hour (recording grades)"
"5-6 hours (web page design)"

Section 1.2.2: Dependent variables

Advantages of mobile computing

The respondents were presented a list of statements that expressed the advantages of mobile computing. The 11 advantages were arranged by letters from A to K. Table 11 shows the advantages list. The respondents then rated their responses on the statements using Likert scale from 1 to 4, where 1 represents "disagree" value and 4 represents "agree" value. The middle value of this scale was 2.50, therefore all scales below or equal to 2.50 were considered "disagree."

Table 11. List of advantages of mobile computing on the survey

ADV-A	Constant accessibility
ADV-B	Collaboration in a common experience
ADV-C	Increase efficiency and organization
ADV-D	Increase enthusiasm for teaching
ADV-E	Increase confidence and computer skill
ADV-F	Better record keeping
ADV-G	Design assignments to meet student needs
ADV-H	Provide higher quality student materials
ADV-I	Improve professor-student communication
ADV-J	Improve data collection in the field
ADV-K	Improve student learning

The highest mean scale was 3.17 for ADV-H or advantage h that states "*provide higher quality student materials*." The score meant the respondents agree with the statement. The next advantages were ADV-I or advantage i, "*improve professor-student communication*," with mean scale 3.17, followed by ADV-C or advantage c, "*increase efficiency and organization*," with mean scale 3.10, ADV-E or advantage e, "*increase confidence and computer skill*" with mean scale 3.07, ADV-K or advantage k for "*improve student learning*" with mean scale 3.07, ADV-A or advantage a for "*constant accessibility*" with mean scale 3.03, and ADV-G or advantage g for "*design assignment to meet student needs*" with mean scale 3.00. All respondents agreed with all the advantages of mobile computing listed on the survey. Figure 16 shows the respondents' perception of advantages of mobile computing. Respondents agreed with all the advantages stated in the survey because the mean scores of their responses were above 2.50 for the scale of 1 (disagree) to 4 (agree).

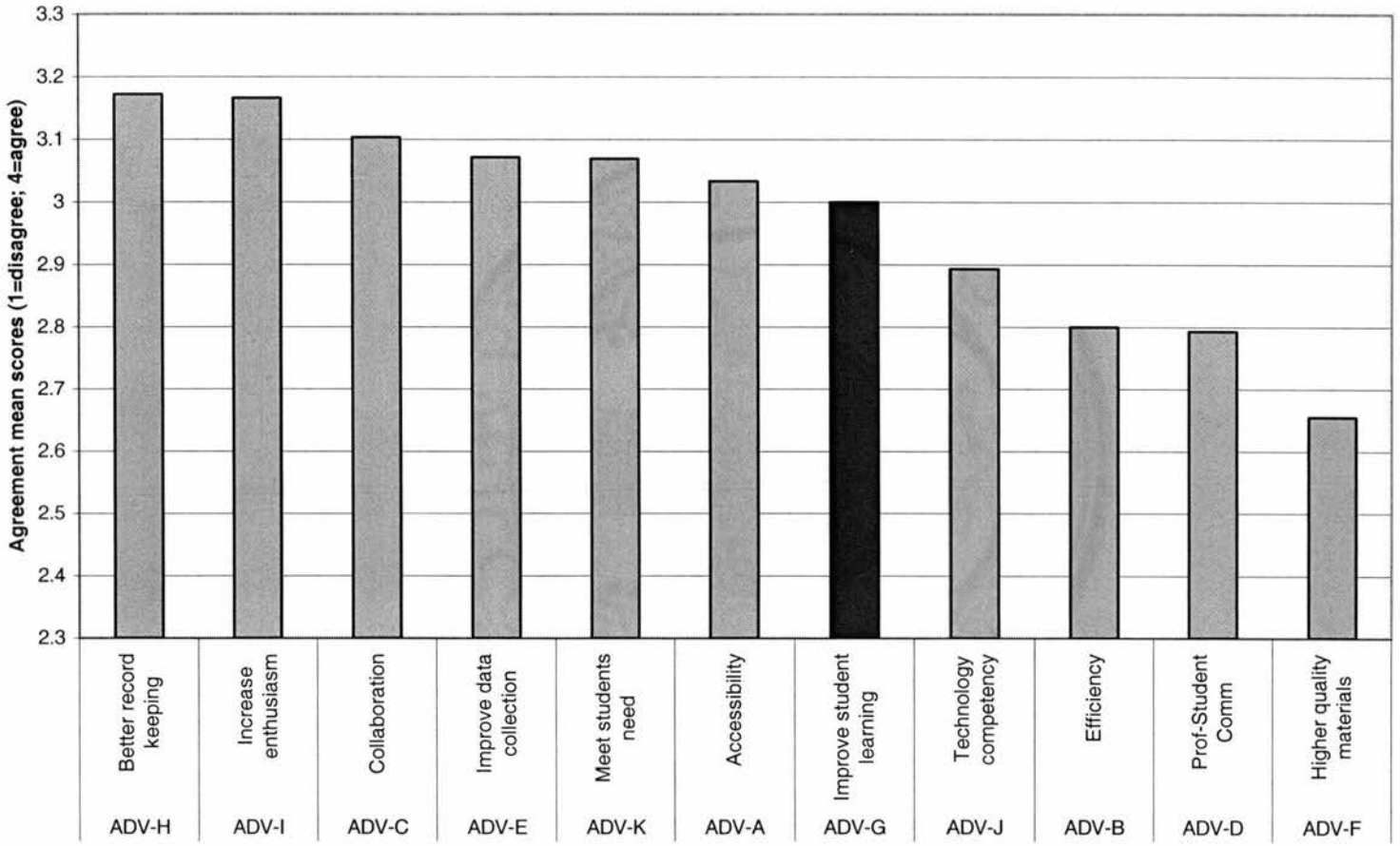


Figure 16. Respondents' agreement with stated advantages of mobile computing (above 2.5 indicates agreement).

The respondents were also asked to add advantages that were not included on the list. Table 12 shows the additional advantages that were not included on the list.

Table 12. Additional comments on the advantages section of the survey

Additional comments on advantages
"Can use in laboratory - data collection and analysis." "Less time spent at photocopy machine." "Faculty and students can share experiences in using the technology. Faculty can learn from students' use of the technology – learning is easier." "Via my students. Personally, I do not have access. Building regional community with peers and instructor into syllabus as a requirement - or connecting to websites, Blackboard." "Flexible workplace & time (can work anywhere, anytime)." "Expansion of student capabilities; Improved communication with field preceptors." "Keep class together." "Available to situations with disability needs." "I'm able to provide multiple ways for students to access information when we are not in class. I am able to work from home approximately 1 day/week (my commute approximately 2 hours/way to work)."
Other comments that could not be considered advantages
"None of these is dependent on a mobile computer. I use my home computer (desktop) for these." "If students are motivated they will learn no matter the material, conditions, etc. If they are less motivated, a laptop is a big temptation to sneak around!"

Disadvantages of mobile computing

The respondents were presented a list of statements that expressed the disadvantages of mobile computing. Nine disadvantages were arranged by letter from A to I. Table 13 shows the disadvantages list. The respondents then rated

their responses on the statements using Likert scale from 1 to 4, where 1 represents "disagree" value and 4 represents "agree" value. The middle value of this scale was 2.50, therefore all scales below or equal to 2.50 would be considered "disagree."

Table 13. List of disadvantages of mobile computing on the survey

DISADV-A	Lack of time for personal activities
DISADV-B	Feeling lonely and isolated
DISADV-C	Too many e-mails to read
DISADV-D	Need for additional training
DISADV-E	Mobile computing is unreliable/easily break
DISADV-F	Limited battery life
DISADV-G	Too expensive
DISADV-H	Too many accessories needed
DISADV-I	Low quality wireless connection

The highest mean score was 2.67 for DISADV-C or disadvantage c that states "*too many e-mails to read*" which meant the respondents agree with the statement. The next highest mean scores were DISADV-A or disadvantage a, "*lack of time for personal activities*," with 2.56 mean score. DISADV-E or disadvantage e, "*mobile computer is unreliable/easily break*," rated 2.50 mean scale. Respondents agreement with these three disadvantages was indicated by the mean scores were above or equal to 2.50.

Mean scales lower than or equal to 2.50 were considered to disagree with the disadvantage statements. The lowest mean scale was for DISADV-B or

disadvantage b, "*feeling lonely and isolated*," with 1.52 mean scale. The next lowest mean scales of disadvantages statements were DISADV-G or disadvantage g, "*too expensive*," with 1.85 mean scale, DISADV-H or disadvantage h, "*too many accessories needed*," with 1.93 mean scale, DISADV-I or disadvantage i, "*low quality wireless connection*," with 2.00 mean scale, DISADV-D or disadvantage d, "*need for additional training*," with 2.33 mean scale, and DISADV-F or disadvantage f, "*limited battery life*," with 2.48. Figure 17 shows the mean scales of respondents' responses on the listed disadvantages statements.

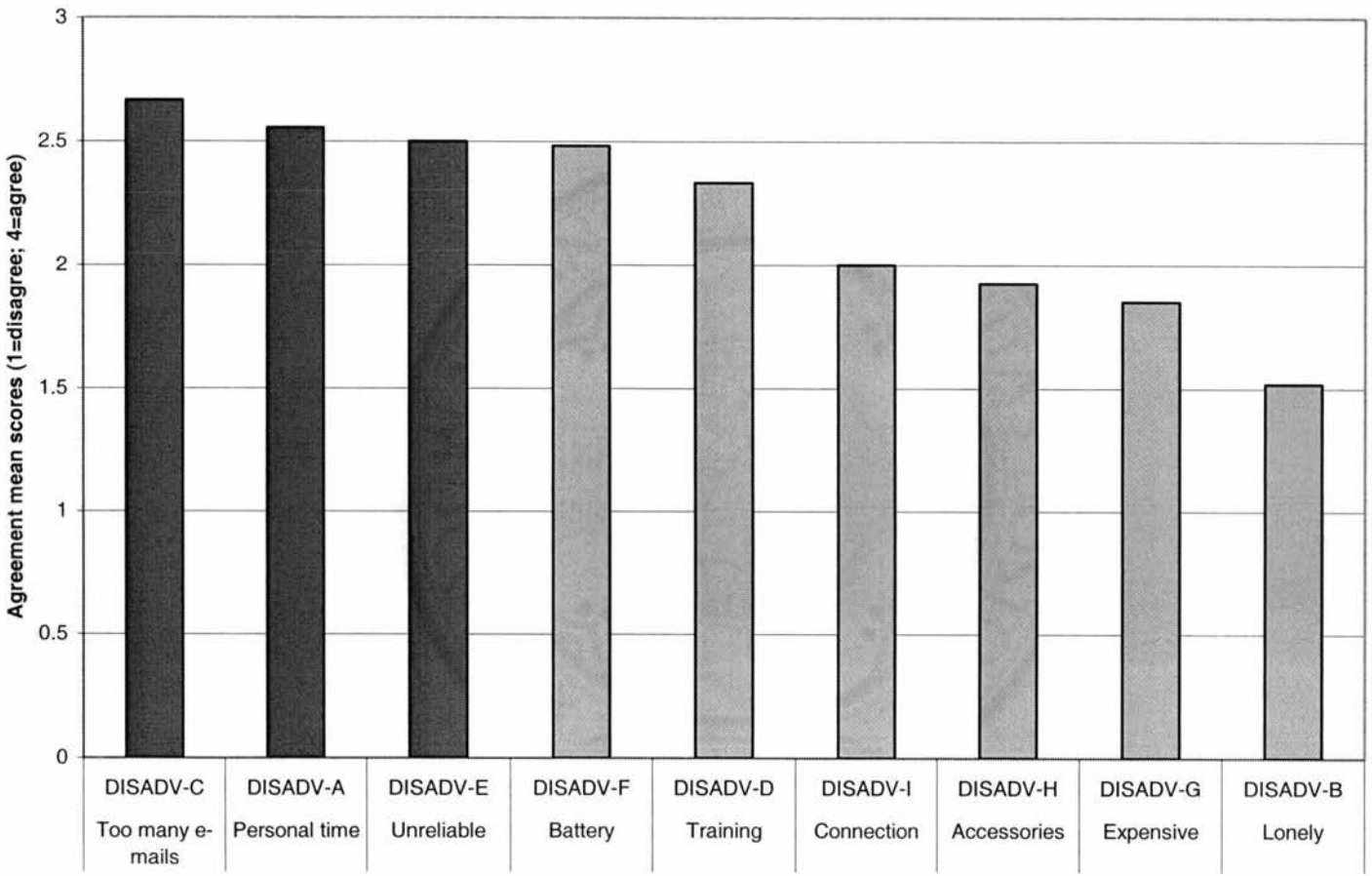


Figure 17. Respondents' agreement with stated disadvantages of mobile computing (above 2.5 indicates agreement)

The respondents were also asked to add some disadvantages that were not included on the list. Table 14 shows the additional disadvantages that were not included on the list. Three respondents or 10% of total respondents expressed that mobile computing in the classroom had created distraction or disruption problem.

Table 14. The respondents' comments on disadvantages of mobile computing.

Additional comments on disadvantages
In some classrooms the need for more electrical outlets lectures are high.
Rooms not conducive; Lack of darkening curtains.
Ergonomically poor for posture and hand position.
Faculty lacking equipment comparable to students.
They're often a distraction in the classroom.
Temptation of distraction.
Disruption in class when students play games.
The prohibitive cost of software is my biggest issue (esp. in the arts).
I live in an isolated place (island--access by ferry boat) and we don't have available some of the high speed options available on the mainland. This can be a disadvantage.

Pattern of computer use

In the survey, respondents filled out two tables that each represents respondents' computer activities during a typical weekday or weekend. "Typical" means the most likely computer activities the respondents did in certain time slot of the weekday or weekend. Each weekday or weekend was divided into four

time slots: (1) Weekday or Weekend time slot 1 for between 6:00 AM to 12:00 PM, (2) Weekday or Weekend time slot 2 for between 12:01 PM to 6:00 PM, (3) Weekday or Weekend time slot 3 for between 6:01 PM to 12:00 AM, (4) Weekday or Weekend time slot 4 for between 12:01 AM to 5:59 AM. The purpose of these two tables was to check whether the respondents were working during 24 hours, seven days a week, known as 24/7, and the possibility of disappearing boundary between office and home. The findings would be useful for illustrating the Hargreaves & Goodson's postmodernism professionalism.

Figure 18 shows that many respondents used e-mail during both weekdays and weekends. The next application they used was wordprocessor. However, the respondents used Power point more than wordprocessor in Weekday time slot 2 or between 12:01 and 6:00 P.M. The next applications they used were Internet browser and chatroom or on-line discussion.

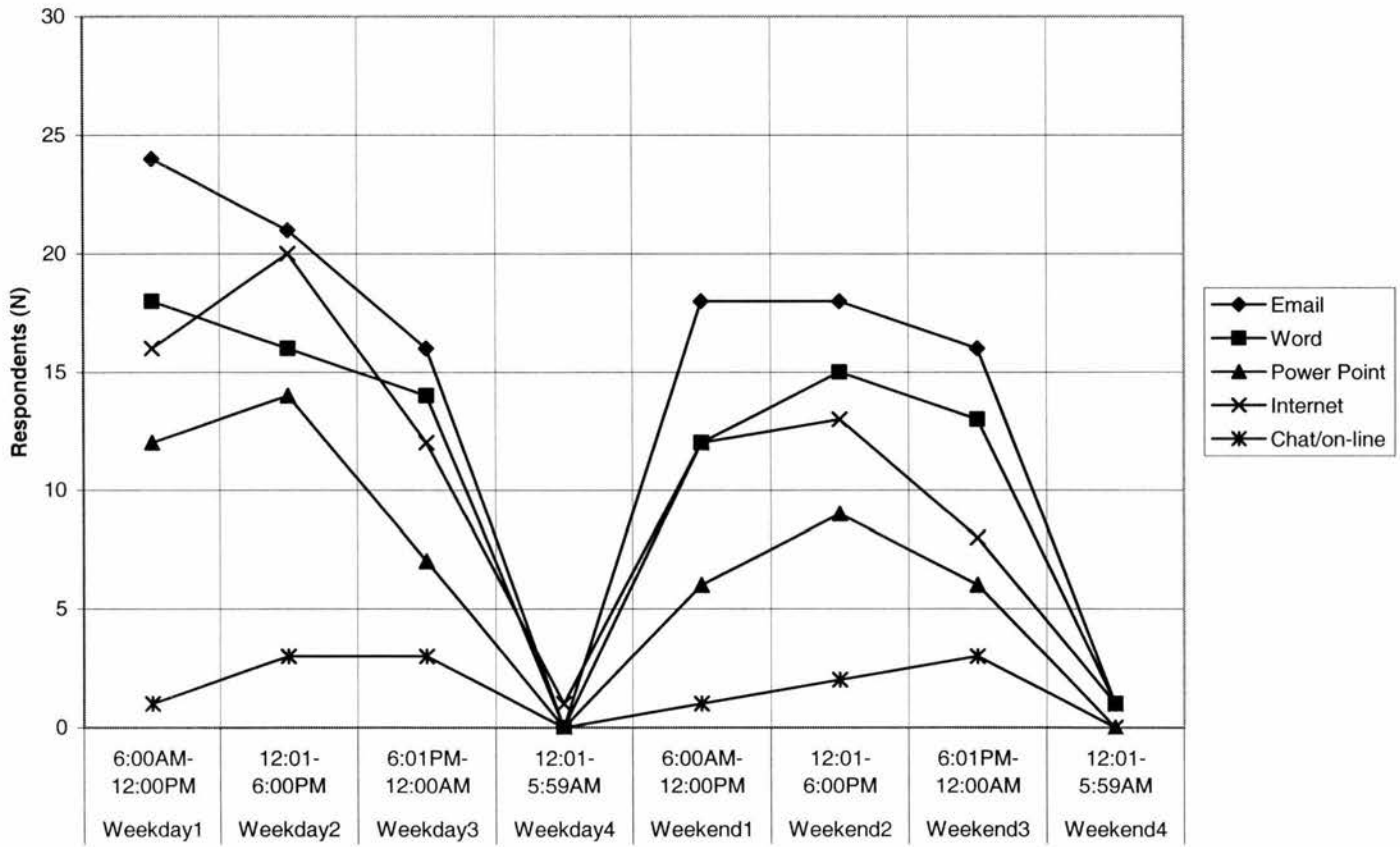


Figure 18. Applications that respondents used while working on laptop computers during weekdays and weekends.

Figure 19 shows that many respondents used their wireless laptop on campus and at home during Weekday time slot 1 and Weekday time slot 2, but they kept using it after they were at home in weekdays and weekends. Some respondents even used the computer on campus during Weekend time slot 1 and Weekend time slot 2. Not many respondents used their computer outside of campus and home, or "other." Only three respondents or 10% used their laptop computers outside home or campus during Weekday time slot 1, Weekday time slot 2, and Weekday time slot 3 from 6:00 AM to midnight.

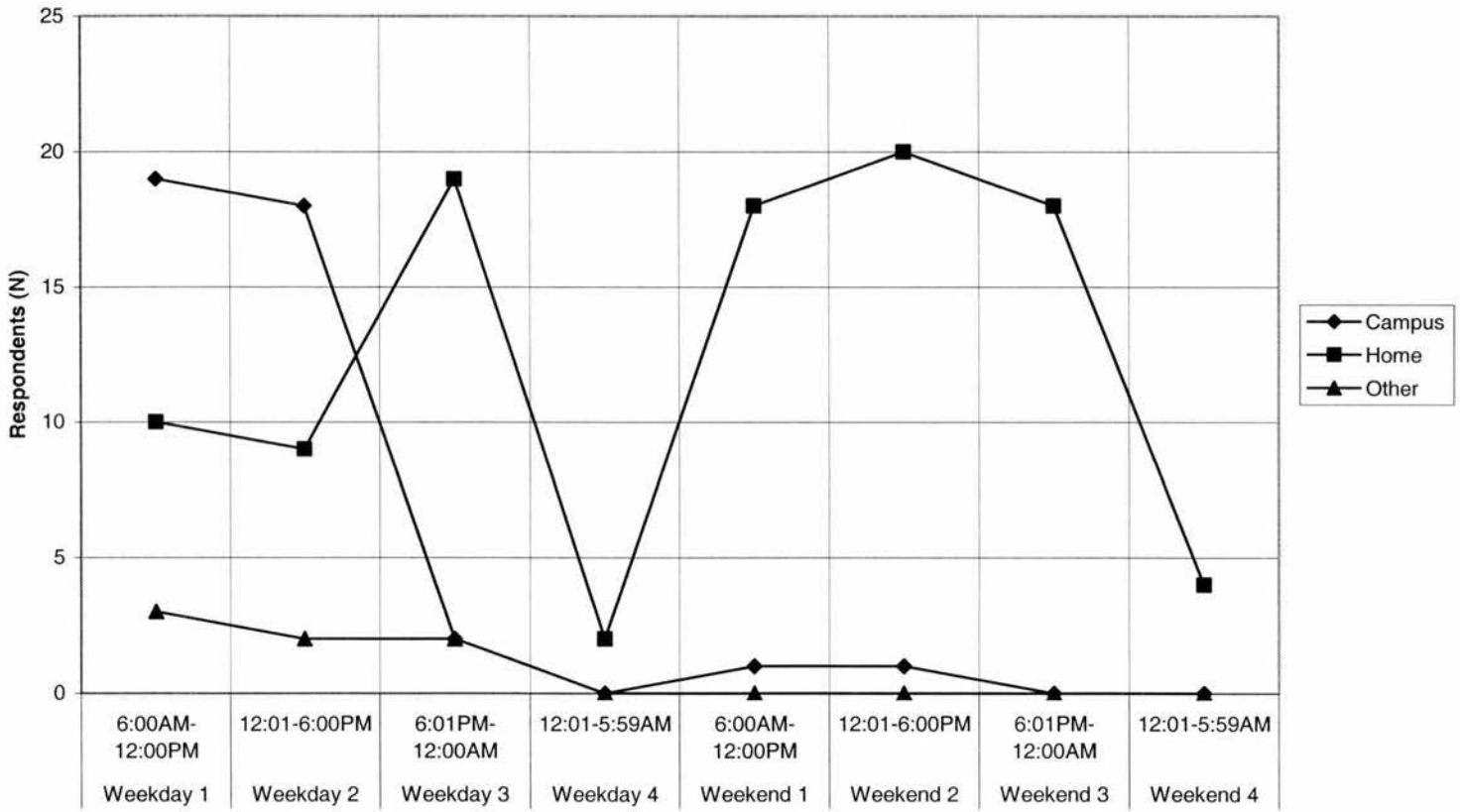
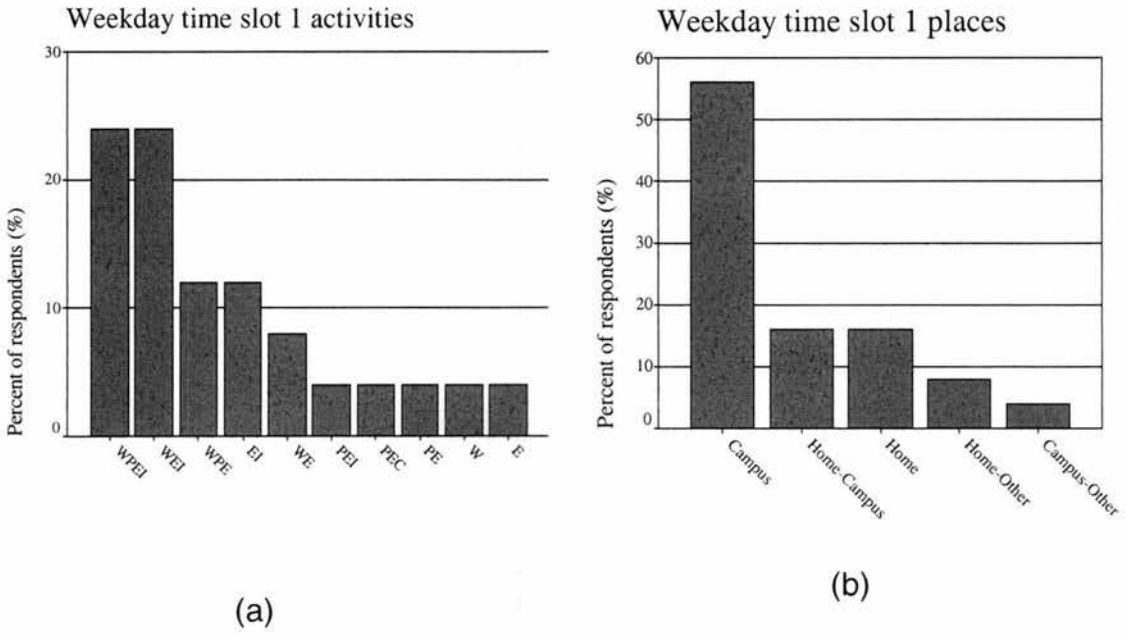


Figure 19. Respondents places of using laptop computers during weekdays and weekends

The survey also provides information about the combination of applications that respondents used in weekday and weekend. The information was arranged based on the time of the weekday and weekend.

Weekday time slot 1: between 6:00 AM-12:00 PM

On Weekday time slot 1 that covered computer activities between 6:00 AM to 12:00 PM, 23 respondents or 77% of total respondents were on-line and worked on either e-mail or Internet research. They worked at 10 kinds of computer activity combinations. Six respondents, or 20%, were worked at WPEI combination or "*word-processing, Power point, e-mail, and Internet research*," and another six respondents or 20% were worked at WEI combination or "*word-processing, e-mail, and Internet research*." Fourteen respondents or 47% were engaged in those computer activities on campus. Figure 20 (a) and 20 (b) show the respondents' computer activities and the place they were worked at those activities on Weekday time slot 1.



Legend

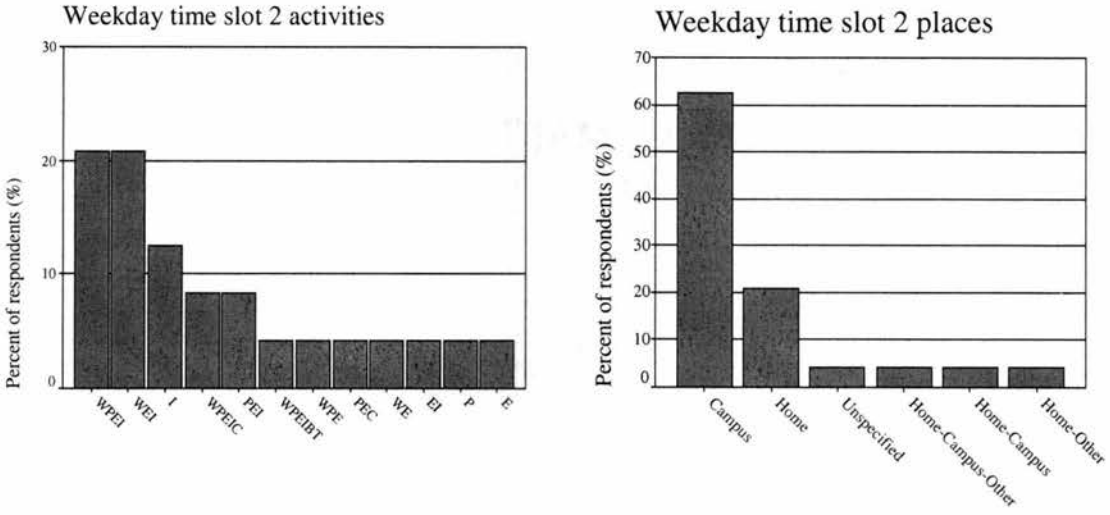
WPEI = Word processing, Power point, E-mail, Internet browsing;
WPE = Word processing, Power point, E-mail;
PEI = Power point, E-mail, Internet browsing;
PEC = Power point, E-mail, chatroom/on-line discussion;
WEI = Word processing, E-mail, Internet browsing;
WE = Word processing, E-mail;
EI = E-mail, Internet browsing;
PE = Power point, E-mail;
W = Word processing;
E = E-mail;

Figure 20. Respondents' Weekday time slot 1 (6:00 AM-12:00 PM) computer activities and places.

Weekday time slot 2: between 12:01 PM-6:00 PM

On Weekday time slot 2 that covered computer activities between 12:01 PM to 6:00 PM, 23 respondents or 77% of total respondents were on-line either worked at e-mail or Internet research. They worked at 12 kinds of computer

activity combinations. Five respondents, or 17%, worked at WPEI combination or "*word-processing, Power point, e-mail, and Internet research*," and another five respondents (17%) were engaged in WEI combination or "*word-processing, e-mail, and Internet research*." Fifteen respondents or 50% of total respondents were engaged in those activities on campus. Figure 21 (a) and 21 (b) show the respondents' computer activities and the place they were during those activities on Weekday time slot 2.



(a) (b)

Legend

WPEIC = Word processing, Power point, E-mail, Internet browsing, chatroom/on-line discussion;

WPEIBT = Word processing, Power point, E-mail, Internet browsing, design course site on Blackboard.com, Uploading files to the course site;

WPEI = Word processing, Power point, E-mail, Internet browsing;

WPE = Word processing, Power point, E-mail;

PEI = Word processing, Power point, Internet browsing;

PEC = Power point, E-mail, chatroom/on-line discussion;

WEI = Word processing, E-mail, Internet browsing;

WE = Word processing, E-mail;

EI = E-mail, Internet browsing;

P = Power point;

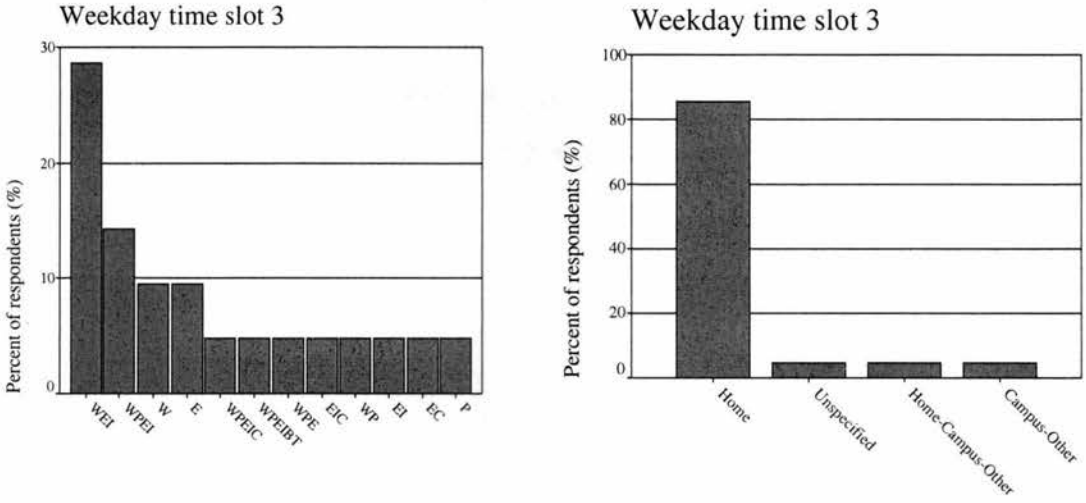
E = E-mail

I = Internet

Figure 21. Respondents' Weekday time slot 2 (12:00-6:00 PM) computer activities and places.

Weekday time slot 3: between 6:01 PM-12:00 AM

On Weekday time slot 3 that covered activities between 6:01 PM to 12:00 AM, 17 respondents or 56.7% of total respondents were on-line worked at either e-mail or Internet research. They worked at 12 kinds of computer activity combinations. Six respondents, or 20%, were engaged in WEI combination or "*word-processing, e-mail, and Internet research*." Another three respondents or 10% were engaged in WPEI combination or "*word-processing, Power point, e-mail, and Internet research*." Eighteen respondents, or 60%, engaged in computer activities at home. Figure 22 (a) and 22 (b) show the respondents' computer activities and the place they were engaged in those activities on Weekday time slot 3.



(a) (b)

Legend

WPEIC = Word processing, Power point, E-mail, Internet browsing, chatroom/on-line discussion;

WPEIBT = Word processing, Power point, E-mail, Internet browsing, design course site on Blackboard.com, Uploading files to the course site;

WPEI = Word processing, Power point, E-mail, Internet browsing;

WPE = Word processing, Power point, E-mail;

EIC = E-mail, Internet browsing, chatroom/on-line discussion;

WEI = Word processing, E-mail, Internet browsing;

WP = Word processing, Power point;

EI = E-mail, Internet browsing;

EC = E-mail, chatroom/on-line discussion;

W = Word processing;

P = Power point;

E = E-mail.

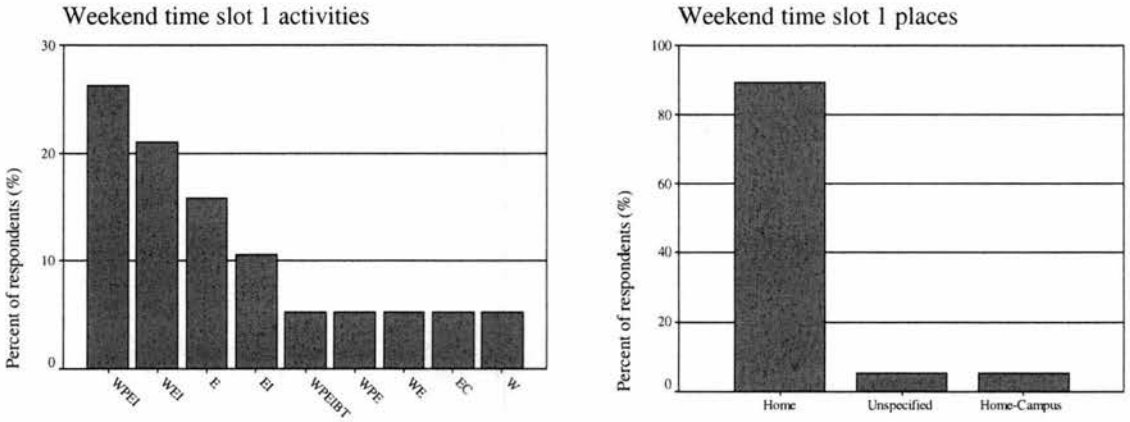
Figure 22. Respondents' Weekday time slot 3 (6:00 PM-12:00 AM) computer activities and places.

Weekday time slot 4: between 12:01 AM-5:59 AM

There were some computer activities on Weekday 4 (12:01 AM-6:00 AM) that covered midnight and early morning. Two respondents or 6.7% of 30 respondents said that they worked on their computers during those hours and the activity was Internet research.

Weekend time slot 1: between 6:00 AM-12:00 PM

On Weekend time slot 1 that covered computer activities between 6:00 AM to 12:00 PM, 23 respondents or 76.7% of total respondents were on-line and engaged in either e-mail or Internet research. They worked at 10 kinds of computer activity combinations. Five respondents or 16.7%, were engaged in WPEI combination or "*word-processing, Power point, e-mail, and Internet research*," another four respondents or 13.3% were engaged in WEI combination or "*word-processing, e-mail, and Internet research*," and three respondents or 10% were worked at e-mail. Seventeen respondents or 56.7% performed their computer activities at home. Figure 23 (a) and 23 (b) show the respondents' computer activities and the place they were engaged in those activities on Weekend time slot 1.



(a) (b)

Legend

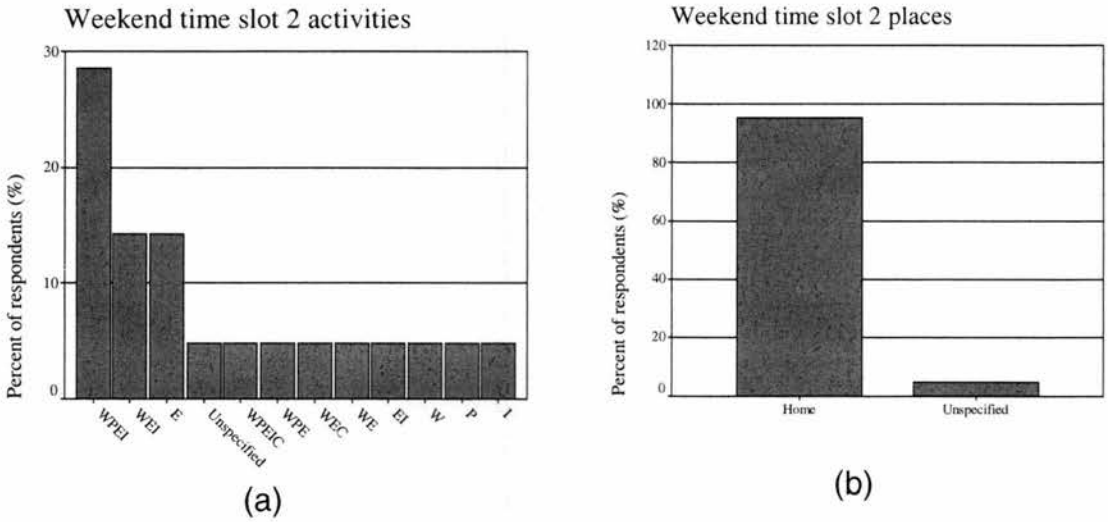
WPEIBT = Word processing, Power point, E-mail, Internet browsing, design course site on Blackboard.com, Uploading files to the course site;
WPEI = Word processing, Power point, E-mail, Internet browsing;
WPE = Word processing, Power point, E-mail;
WEI = Word processing, E-mail, Internet browsing;
WE = Word processing, E-mail;
EI = E-mail, Internet browsing;
EC = E-mail, chatroom/on-line discussion;
W = Word processing;
E = E-mail.

Figure 23. Respondents' computer activities and places during Weekend time slot 1 (6:00 AM-12:00 PM).

Weekend time slot 2: between 12:01 PM-6:00 PM

On Weekend time slot 2 that covered computer activities between 12:01 PM to 6:00 PM, 23 respondents or 76.7% were on-line either worked at e-mail or Internet research. They were engaged in 12 kinds of combination. Six respondents or 20%, were engaged in WPEI combination or "*word-processing, Power point, e-mail, and Internet research*," another three respondents or 10% of

total respondents were engaged in WEI combination or "*word-processing, e-mail, and Internet research*," and three respondents or 30% were engaged in e-mail. Twenty respondents or 66.7% were engaged in those activities at home. Figure 24 (a) and 24 (b) show the respondents' computer activities and the place they were worked at those activities on Weekend time slot 2.



Legends

WPEIC = Word processing, Power point, E-mail, Internet browsing, chatroom/on-line discussion;

WPEI = Word processing, Power point, E-mail, Internet browsing;

WPE = Word processing, Power point, E-mail;

WEC = Word processing, Power point, chatroom/on-line discussion;

WEI = Word processing, E-mail, Internet browsing;

WE = Word processing, E-mail;

EI = E-mail, Internet browsing;

W = Word processing;

P = Power point;

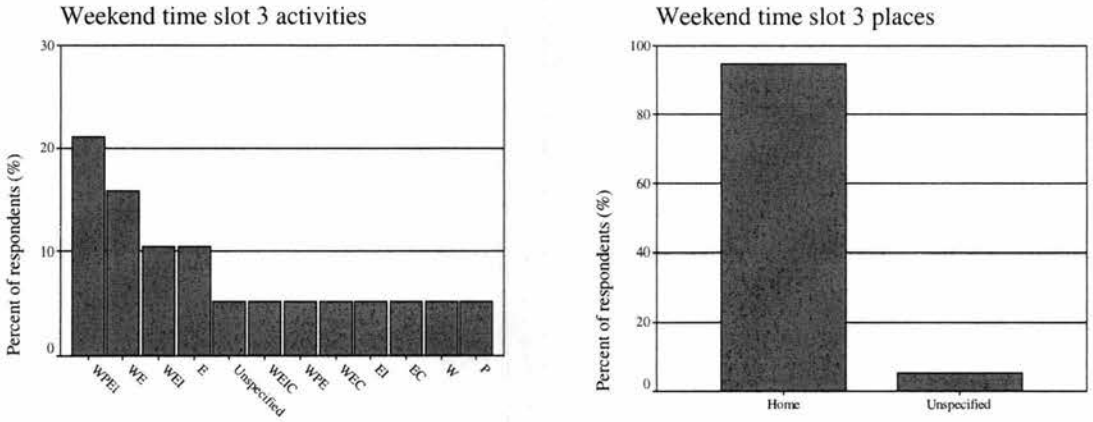
E = E-mail.

I = Internet browsing;

Figure 24. Respondents' computer activities and places during the weekend 2 (12:00 PM-6:00 PM).

Weekend time slot 3: between 6:01 PM-12:00 AM

On Weekend time slot 3 that covered activities between 6:00 PM to 12:00 AM, 16 respondents or 53.3% were on-line worked at either e-mail or Internet research. They performed 12 combinations of computer activity. The majority of respondents, four respondents or 13.3%, were engaged in WPEI combination or "*word-processing, Power point, e-mail, and Internet research*," and another three respondents or 10% were engaged in WE combination or "*word-processing, e-mail.*" Eighteen respondents or 60% did the computer activities at home. Figure 25 (a) and 25 (b) show the respondents' computer activities and the place they were worked at those activities on Weekend time slot 3.



(a) (b)

Legends

WPEI = Word processing, Power point, E-mail, Internet browsing;
WEIC = Word processing, E-mail, Internet browsing, chatroom/on-line discussion;
WPE = Word processing, Power point, E-mail;
WEC = Word processing, E-mail, chatroom/on-line discussion;
WEI = Word processing, E-mail, Internet browsing;
WE = Word processing, E-mail;
EI = E-mail, Internet browsing;
EC = E-mail, chatroom/on-line discussion;
W = Word processing;
P = Power point
E = E-mail

Figure 25. Respondents' computer activities and places during the weekend 3 (6:00 PM-12:00 AM).

Weekend 4: time slot between 12:01 AM-6:00 AM)

In weekend 4 (12:01 AM-6:00 AM), there were four respondents or 13.3% of total respondents who said that they were awake and engaged in some computer activities between the midnight and early morning time slot. While one of them (3.3%) stated he or she was engaged in a combination of WEI activities

or "*word processing, E-mail, and Internet browsing*," the other three respondents (10%) did not specify their computer activities during that period.

Summary of respondents' pattern of computer use

More than 15 respondents or 50% utilized e-mail, wordprocessor, and Power point applications simultaneously in weekdays and weekends. They worked on their laptop computers on campus and at home, but only small number of respondents worked on computer outside of campus and home. Reviewing the combination of applications the respondents used in more details, more than 40% of respondents used combination of E-mail, wordprocessor, and Internet browser during Weekday time slot 1 and 2 when most of them were on campus. Half of them also used Power point presentation. The pattern was almost similar during Weekend time slot 1 and 2, but in a smaller percentage. Around 30% of respondents used the combination of E-mail, wordprocessor, Power point, and Internet browser while they were working at home.

Twenty-three respondents, or 77%, worked at computer during Weekdays time slot 1 and 2. About the same number of respondents also worked at computer during Weekends slot 1 and 2. The number declined in Weekdays time slot 3 to 57% and Weekends time slot 4 to 53%. These respondents were working on four applications: wordprocessing, Power Point, E-mail, and Internet research.

Section 1.3: Testing the hypotheses

In this section, the correlations of four independent variables and two dependent variables were analyzed. The four independent variables are: (1) teaching methods, (2) teaching styles, (3) technology adoption stage, and (4) mobile computer use in the classroom. The two dependent variables are: (1) advantages of mobile computing and (2) disadvantages of mobile computing.

The quantitative analysis was used to test four hypotheses:

Null Hypothesis 1: Respondents' teaching methods do not correlate with their perceptions on the advantages and disadvantages of mobile computing.

Null Hypothesis 2: Respondents' teaching styles do not correlate with their perceptions on the advantages and disadvantages of mobile computing.

Null Hypothesis 3: Respondents' stages of technology adoption do not correlate with their perceptions on the advantages and disadvantages of mobile computing.

Null Hypothesis 4: Respondents' mobile computer use do not correlate with their perceptions on the advantages and disadvantages of mobile computing.

The organization of the results of these statistical analysis was shown on Table 15.

Table 15. The organization of statistical analysis of the survey results

Phase 1	Hypothesis 1: Teaching methods and advantages/disadvantages Hypothesis 2: Teaching styles and advantages/disadvantages Hypothesis 3: Technology adoption stage and advantages/disadvantages Hypothesis 4: Average percentage of classroom time using mobile and advantages/disadvantages Conclusion of hypotheses testing

Hypothesis 1: Correlation between respondents' teaching methods and their perceptions on advantages and disadvantages of mobile computing

Correlation between respondents' teaching methods and advantages

Null Hypothesis 1 was "*respondents' teaching methods do not correlate with their perceptions on the advantages and disadvantages of mobile computing.*" The survey provided data for analyzing the correlation between respondents' teaching methods and their perceptions on advantages and disadvantages of mobile computing. Statistical analysis using SPSS was employed for analysis of variance or ANOVA, and Pearson *r* to analyze significant correlation of respondents' teaching methods and respondents' perceptions.

Each respondent selected one of five teaching methods that they thought was the closest to their teaching practice: "*Lecture*," "*Discussion*," "*Students lead the class*," "*Students work on projects*," or "*Other/All of them.*" Teaching methods were the independent variables, while eleven advantages, and nine disadvantages were the dependent variables. Analysis of variance was

employed to compare means of respondents' agreement rate based on respondents' five teaching methods.

First, using analysis of variance, the relationship between respondents' teaching methods and their perception of the advantages of mobile computing was investigated. F value of advantage "*collaboration in common experience*" was 2.569 that was below the critical value *F* for α=.05 for degree of freedom (*df*) of 4 and 25 is $F_{.05}(4,25)=2.76$. The *F* value of other advantages were also not bigger than the critical value of *F* in its comparative degree of freedom. Using analysis of variance, there was no significant correlation between respondents' teaching methods and their perceptions on advantages of mobile computing (Appendix 6).

Second, using Pearson *r* correlation analysis, the correlation of two teaching methods, "*Lecture*" and "*Discussion*," were significant with three advantages. The correlation of "*Lecture*" method and advantages "*collaboration in a common experience*" and "*improve professor-student communication*" were significant $r = -.431$ and $r = -.497$ respectively. That these were negative correlation meant that the higher the professors rated "*Lecture*" method, the lower they rated these two advantages. The correlation of "*Discussion*" method and advantage "*increase enthusiasm for teaching*" was significant $r = .376$. The positive correlation meant that the higher the professors rated "*Discussion*" method, the higher they rated this advantage. Therefore, Null Hypothesis 1 is

rejected. Respondents' teaching methods did, in certain instances, correlate with their perceptions on the advantages.

Table 16. Pearson *r* correlation between respondents' teaching methods and their perception of advantages of mobile computing.

Teaching methods	Advantages	Pearson	Significan
Lecture	"collaboration in common experience"	-0.431	(*)
Lecture	"improve professor-student communication"	-0.497	(**)
Discussion	"increase enthusiasm for teaching"	0.376	(*)
(*) Correlation is significant at the 0.05 level (2-tailed). (**) Correlation is significant at the 0.01 level (2-tailed).			

The mean plots showed that some respondents who practiced certain teaching methods agreed with some of the advantages that were listed on the survey. Agree means their mean score was above 2.5 for a Likert scale between 1 for disagree and 4 agree. All teaching methods agreed with the advantage "*constant accessibility*," "*increase confidence and computer skill*," and "*provide higher quality student materials*."

Looking into each teaching method, the mean plots showed that 20% respondents who chose "*Discussion*" method agreed with all advantages of mobile computing, 23.3% respondents who chose "*Other/All of them*" method agreed with the 10 advantages and disagreed with one advantage: "*better record keeping*," 23.3% respondents who chose "*Students work on project*" method also agreed with the 10 advantages and disagreed with one advantage: "*improve data collection in the field*."

Approximately 33% respondents who chose "*Lecture*" method agreed with the seven advantages and disagreed with the four advantages. The advantages that they agreed upon were (1) "*constant accessibility*;" (2) "*increase efficiency and organization*;" (3) "*increase confidence and computer skill*;" (4) "*design assignment to meet students need*;" (5) "*provide higher quality student materials*;" (6) "*improve data collection in the field*;" and (7) "*improve student learning.*" Four advantages that respondents with "*Lecture*" method disagreed upon are: (1) "*collaboration in common experience*;" (2) "*increase enthusiasm for teaching*;" (3) "*better record keeping*;" and (4) "*improve professor-student communication.*"

One respondent or 3.33% who chose "*Students lead the class*" method agreed with the five advantages and disagreed with the six advantages. Five advantages this respondent agreed upon are (1) "*constant accessibility*;" (2) "*increase confidence and computer skill*;" (3) "*provide higher quality student materials*;" (4) "*improve professor-student communication*;" (5) "*improve data collection in the field.*" Six advantages they disagreed upon are: (1) "*collaboration in common experience*;" (2) "*increase efficiency and organization*;" (3) "*increase enthusiasm for teaching*;" (4) "*better record keeping*;" (5) "*design assignment to meet students need*;" and (6) "*improve student learning.*" Figure 26 summarizes the mean plots to show the relationship of five teaching methods and 11 advantages.

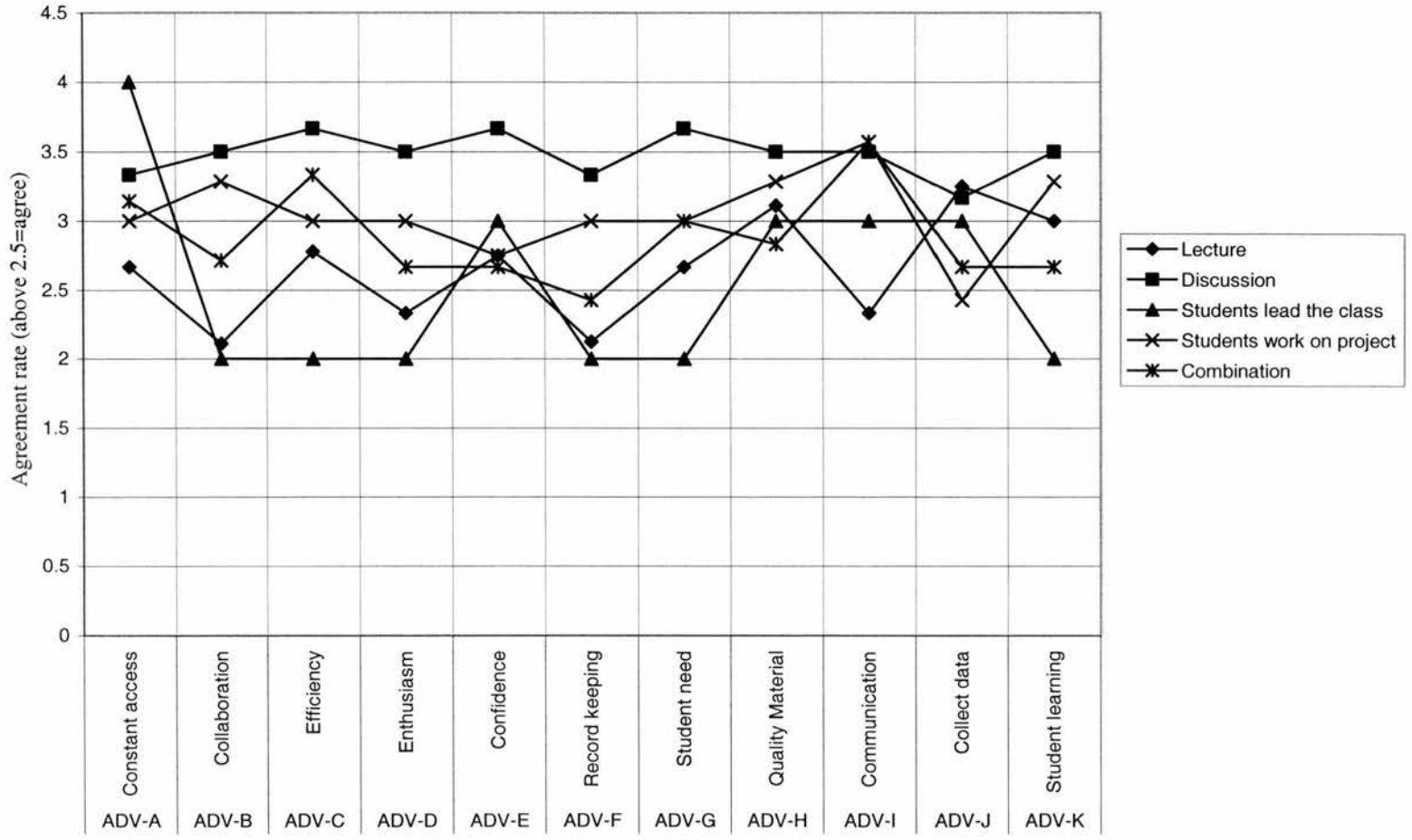


Figure 26. Mean plots of respondents' agreement rate on the advantages of mobile computing based on their teaching methods (above 2.5 indicates agreement).

Correlation between respondents' teaching methods and disadvantages

The relationship between respondents' teaching methods and their perception of the disadvantages of mobile computing was tested. *F* value of disadvantage "*lack of time for personal activities*" was $F = .663$ that was below the critical value of *F*. Indeed, the *F* critical values for $\alpha = .05$ for degree of freedom (*df*) of 4 and 22 is $F.05(4,22) = 2.82$. Similar cases also happened to other disadvantages that there was no output F values bigger than the critical value of *F* in its comparative degree of freedom. In sum, no significant correlation was found between respondents' teaching methods and their perceptions on disadvantages of mobile computing (Appendix 7).

However, using Pearson *r* correlation analysis, the correlation "Students work on project" teaching method with disadvantage "[mobile computing is] too expensive" was significant $r = -.495$ (Table 17). Therefore, Null Hypothesis 1 is rejected because in the case of one method, respondents' teaching method also correlated with their perceptions of the disadvantages.

Table 17. Pearson *r* correlation between respondents' teaching methods and their perception of advantages of mobile computing

Teaching methods	Disadvantages	Pearson r	Significant
Students work on project	"too expensive"	-0.495	(*)
(*) Correlation is significant at the 0.05 level (2-tailed).			

Figure 27 summarizes the significant Pearson *r* correlation scores between respondents' teaching styles and the advantages and disadvantages of

mobile computing. Null Hypothesis 1, "respondents' teaching methods do not correlate with their perceptions on the advantages and disadvantages of mobile computing" was rejected both for advantages and disadvantages of mobile computing.

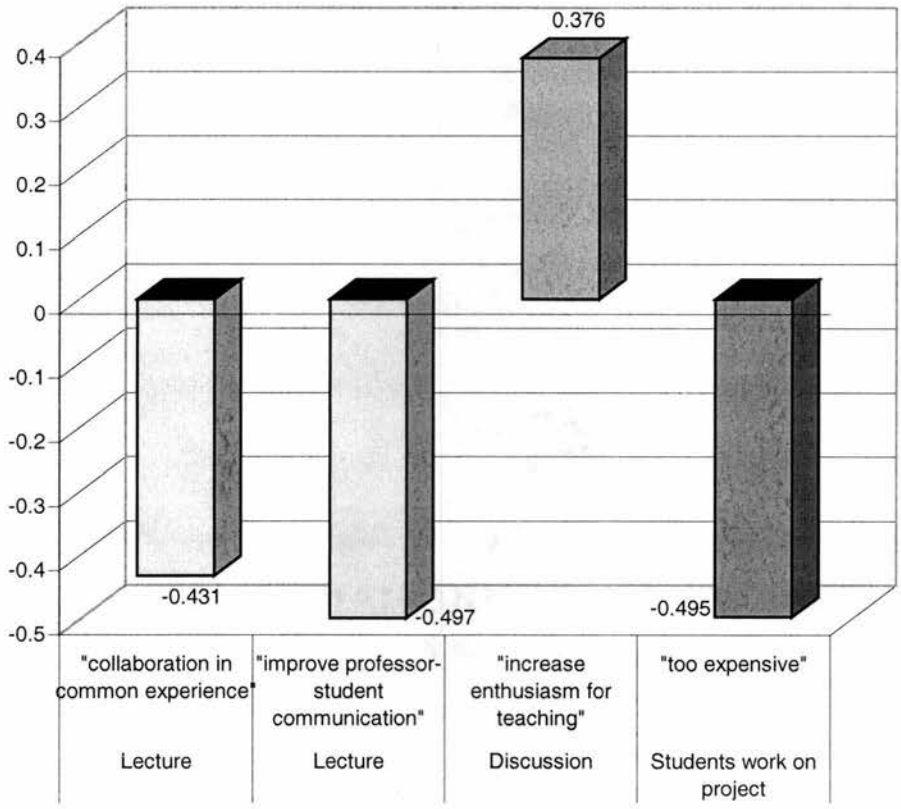


Figure 27. Findings rejecting Null Hypothesis 1.

The mean plots that correlated the advantages and teaching methods provided information about the correlation between some of respondents' teaching methods and their disagreement with some disadvantages listed on the survey. Agree means the respondents' mean score was above 2.5 for a Likert scale between 1 for disagree and 4 for agree.

Mean plots of disadvantages showed more respondents' disagreed with the disadvantages of mobile computing. Respondents who chose "*Discussion*" and "*Students work on project*" methods disagreed with all disadvantages listed on the survey. However, the mean plots showed some respondents with certain teaching methods agreed with some advantages of mobile computing listed on the survey. Respondents who chose "*Lecture*" and "*Other/All of them*" methods agreed with "*lack of time for personal activities*," "*too many e-mails to read*," "*need more training*," "*unreliable or easily broke*," and "*limited battery life*."

Respondents who practiced "*Students lead the class*" method agreed with the "*lack of time for personal activities*" and "*low quality wireless connection*." Figure 28 summarizes the mean plots to show the relationship of five teaching methods and nine disadvantages.

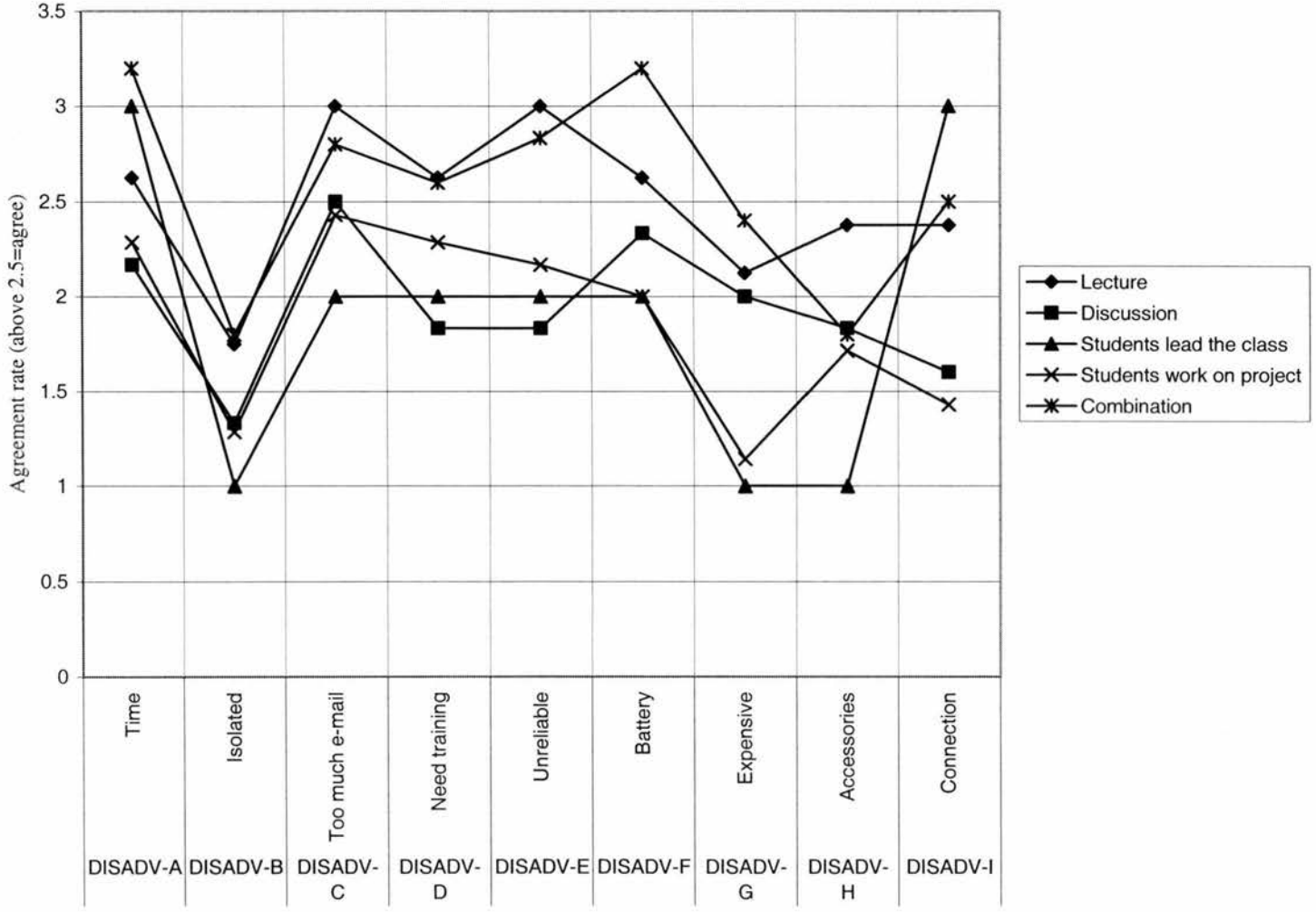


Figure 28. Mean plots of respondents' agreement rate on the disadvantages of mobile computing based on their teaching methods (above 2.5 indicates agreement).

Hypothesis 2: Correlation between respondents' teaching styles and their perceptions of advantages and disadvantages of mobile computing

Null Hypothesis 2 was "*respondents' teaching styles do not correlate with their perceptions on the advantages and disadvantages of mobile computing.*" The survey provided data for analyzing the correlation between respondents' teaching styles and their perception of advantages of mobile computing. Statistical analysis using SPSS was employed for analysis of variance, "ANOVA," and Pearson *r* to analyze significant correlation respondents' teaching styles and respondents' perceptions of eleven advantages, and nine disadvantages of mobile computing.

First, the relationship between respondents' teaching styles and their perception of the advantages of mobile computing was investigated. *F* value of advantage "*constant accessibility*" was 1.988 that was below the critical value *F* for α=.05 for degree of freedom (*df*) of 4 and 23 is *F.05*(4,23)=2.80. The similar cases also happened to other advantages that there was no output *F* values that were bigger than the critical value of *F* in its comparative degree of freedom. Using analysis of variance, there was no significant correlation between respondents' teaching styles and their perceptions on advantages of mobile computing (Appendix 8).

Using similar analysis of variance procedure, the relationship between respondents' teaching styles and their perception of the disadvantages of mobile computing was investigated. *F* value of disadvantage "*too many e-mails to read*" was 1.501 that was below the critical value *F* for α=.05 for degree of freedom (*df*)

of 4 and 20 is *F.05*(4,20)=2.87. Other disadvantages were similar in that there were no output *F* values that were bigger than the critical value of *F* in its comparative degree of freedom. Using analysis of variance, there was no significant correlation between respondents' teaching styles and their perceptions on disadvantages of mobile computing (Appendix 9).

Second, using Pearson *r* correlation analysis, the data of significant correlations between teaching styles and advantages were presented from "*Personal Model*" to "*Delegator*" teaching styles.

The Pearson *r* correlation between "*Personal Model*" teaching style and advantage "*collaboration in common experience*" was significant $r = .410$. Positive correlation meant that the higher the respondents rated this teaching style as representing their own, the higher they would rate this advantage.

The correlation between "*Expert*" teaching style and advantage "*constant accessibility*" was significant $r = -.389$. Negative correlation meant that the higher the respondents rated the "*Expert*" teaching style as representing their own, the lower they rated this advantage. The correlation between "*Expert*" teaching style and advantage "*collaboration in common experience*" was also significant $r = -.500$. The negative correlation meant the higher the respondents rated Expert teaching style, the lower they rated this advantage. The correlation between "*Expert*" teaching style and advantage "*improve professor-student communication*" was significant $r = -.576$. The negative correlation meant the

higher the respondents rated "*Expert*" teaching style, the lower they rated this advantage.

The correlation between "*Formal Authority*" teaching style and advantage "*increase efficiency and organization*" was significant $r = -.454$. The negative correlation meant that the higher the respondents rated this teaching style as representing their own, the lower they rated this advantage. The correlation between "*Formal Authority*" teaching style and advantage "*increase confidence and computer skill*" was significant $r = -.473$. The negative correlation meant that the higher the respondents rated this teaching style, the lower they rated this advantage. The correlation between "*Formal Authority*" teaching style and advantage "*design assignment to meet student needs*" was significant $r = -.490$. The negative correlation meant that the higher the respondents rated this teaching style, the lower they rated this advantage. The correlation between "*Formal Authority*" teaching style and advantage "*provide higher quality student materials*" was significant $r = -.415$. The negative correlation meant that the higher the respondents rated this teaching style, the lower they rated this advantage.

The correlation between "*Facilitator*" teaching style and advantage "*better record keeping*" was significant $r = .405$. The positive correlation meant that the higher the respondents rated this teaching style as representing their own, the higher they rated this advantage. The correlation between "*Facilitator*" teaching style and advantage "*improve professor-student communication*" was significant

$r = .470$. The positive correlation meant that the higher the respondents rated this teaching style, the higher they rated this advantage.

The correlation between "*Delegator*" and advantage "*improve professor-student communication*" was significant $r = .423$. The positive correlation meant that the higher the respondents rated this teaching style as representing their own, the higher they rated this advantage.

Null Hypothesis 2 for the relationship between teaching styles and advantages of mobile computing was rejected because there were some significant correlations between respondents' teaching styles and their perception of some of the advantages of mobile computing. However, Null Hypothesis 2 the relationship between teaching styles and disadvantages was accepted because there was no significant correlation between respondents' teaching styles and their perception of the disadvantages of mobile computing. Figure 29 and Table 18 show the correlation between respondents' teaching styles and their perception of advantages of mobile computing.

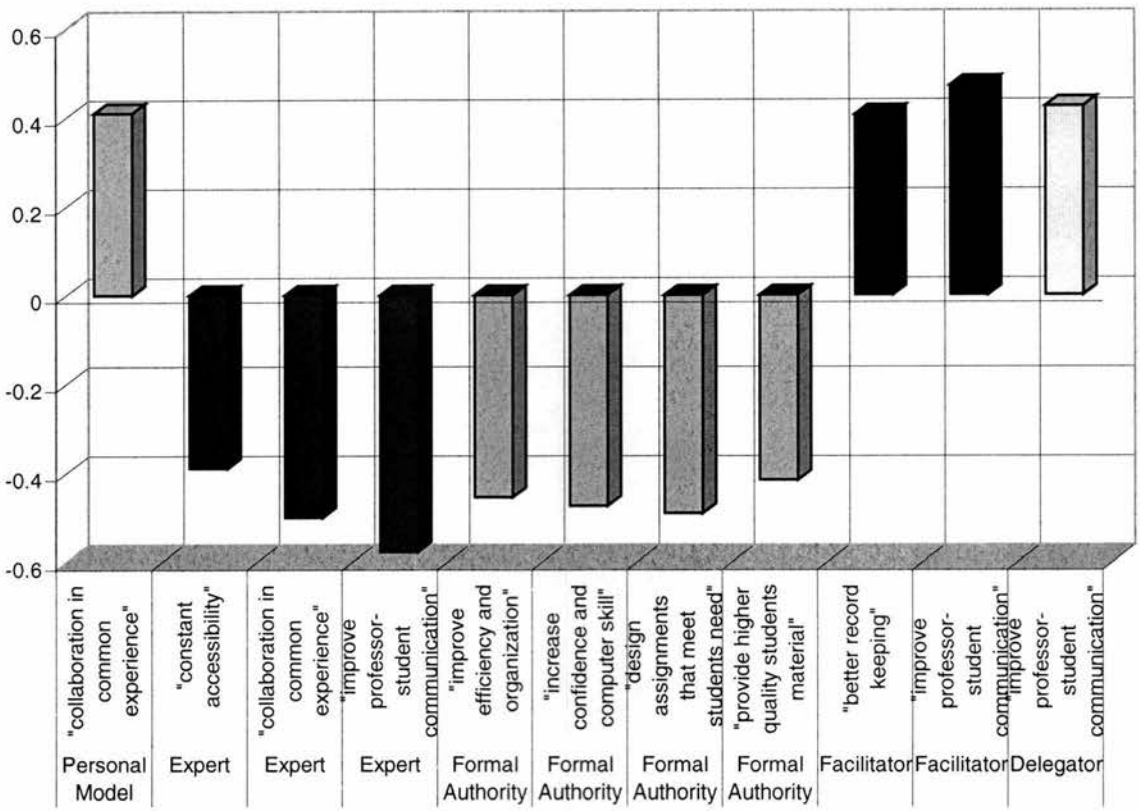


Figure 29. The significant Pearson *r* correlation scores between respondents' teaching styles and advantages.

Table 18. Pearson *r* correlation between respondents' teaching styles and their perception of advantages and disadvantages of mobile computing.

Teaching styles	Advantages	Pearson *r*	Significant
Personal Model	"collaboration in common experience"	0.41	(*)
Expert	"constant accessibility"	-0.389	(*)
Expert	"collaboration in common experience"	-0.500	(**)
Expert	"improve professor-student communication"	-0.576	(**)
Formal Authority	"improve efficiency and organization"	-0.454	(*)
Formal Authority	"increase confidence and computer skill"	-0.473	(*)
Formal Authority	"design assignments that meet students need"	-0.490	(*)
Formal Authority	"provide higher quality students material"	-0.415	(*)
Facilitator	"better record keeping"	0.405	(*)
Facilitator	"improve professor-student communication"	0.47	(*)
Delegator	"improve professor-student communication"	0.423	(*)

(*) Correlation is significant at the 0.05 level (2-tailed).

(**) Correlation is significant at the 0.01 level (2-tailed).

Mean plots of advantages and disadvantages showed the line above or equal to 2.5 that means agreed with the advantages and disadvantages of mobile computing. Respondents who chose "*Expert*" style disagreed with the advantages "*constant accessibility*," "*collaboration in a common experience*," and "*better record keeping*." Other respondents agreed with all advantages. Figure 30 summarizes the respondents' agreement rate on advantages of mobile computing.

Respondents who chose "*Formal Authority*" agreed with four disadvantages. Those who chose "*Expert*" and "*Delegator*" agreed with three disadvantages. Other respondents disagreed with all disadvantages of mobile computing. Figure 31 shows the respondents' agreement rate on disadvantages of mobile computing.

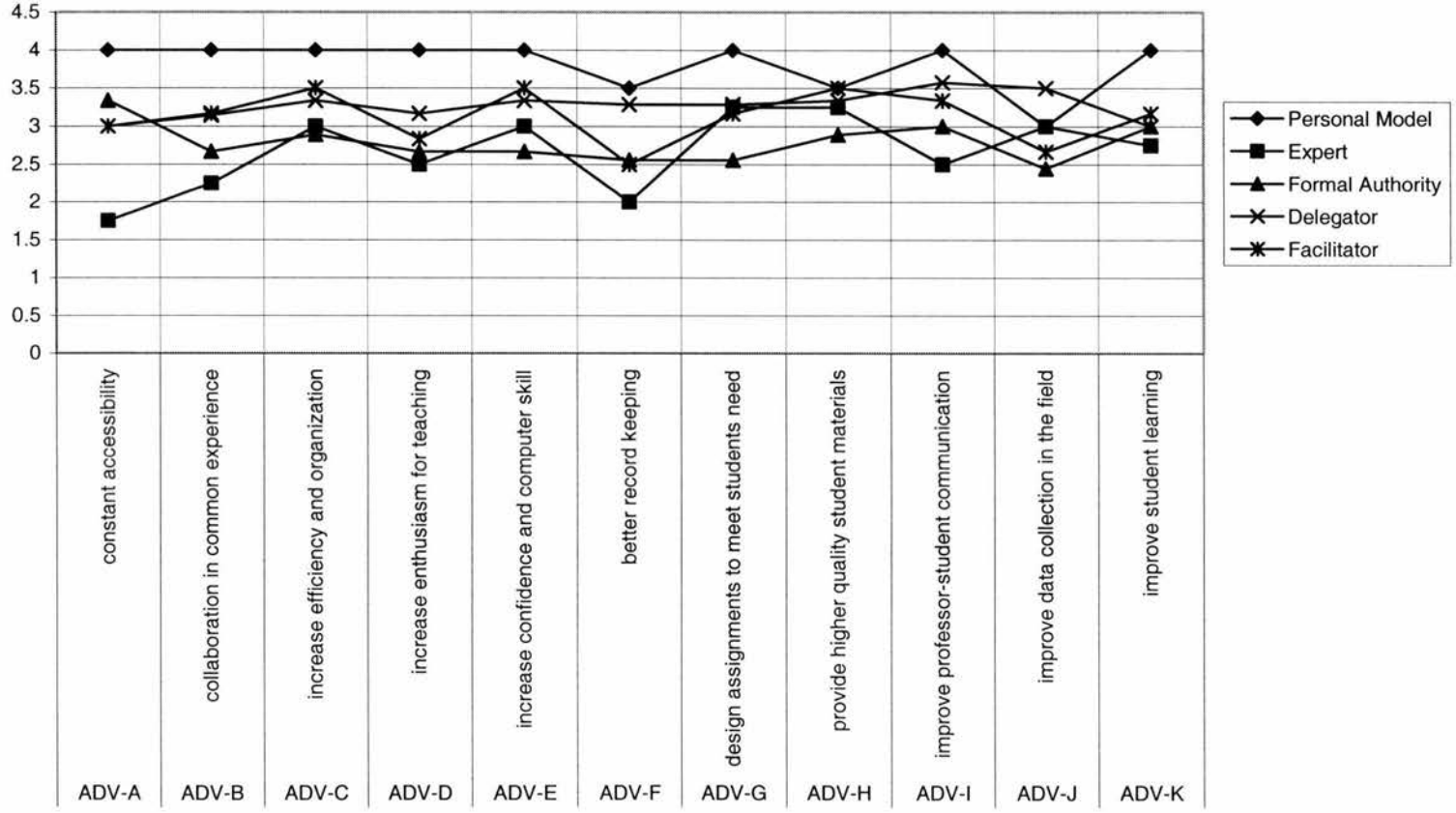


Figure 30. Meanplots of respondents' Teaching Styles and advantages of mobile computing (above 2.5 indicates agreement).

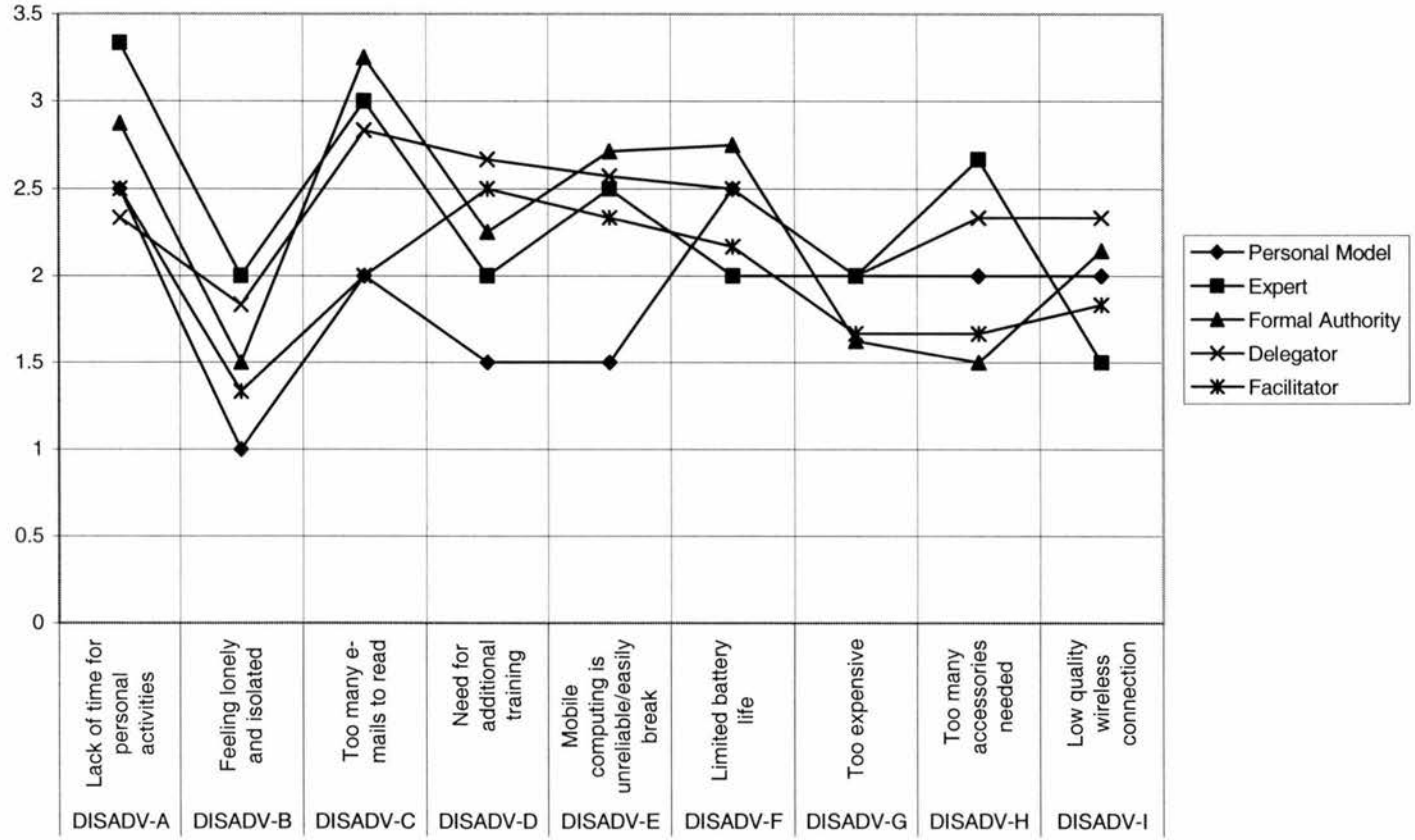


Figure 31. Meanplots of respondents' Teaching Styles and disadvantages of mobile computing (above 2.5 indicates agreement).

Hypothesis 3: Testing the correlation between respondents' technology adoption stages and their perception of advantages and disadvantages of mobile computing

Null Hypothesis 3 was "*respondents' stages of technology adoption do not correlate with their perceptions on the advantages and disadvantages of mobile computing.*" The survey provided data for analyzing the correlation between respondents' technology adoption stages and their perception of advantages and disadvantages of mobile computing. Statistical analysis using SPSS was employed for analysis of variance or ANOVA, and Pearson *r* to analyze significant correlation respondents' technology adoption stages and respondents' perceptions of eleven advantages, and nine disadvantages of mobile computing.

First, the relationship between respondents' technology adoption stages and their perception of the advantages of mobile computing was investigated. *F* value of advantage "*improve data collection in the field*" was 1.604 that was below the critical value *F* for α=.05 for degree of freedom (*df*) of 4 and 17 is *F.05*(4,17)= 2.96. *F* score for other advantages was not higher than critical value of *F* in its comparative degree of freedom. Using analysis of variance, there was no significant correlation between respondents' teaching styles and their perceptions on advantages of mobile computing (Appendix 10).

Using similar analysis of variance procedure, the relationship between respondents' technology adoption stages and their perception of the disadvantages of mobile computing was investigated. *F* value of disadvantage "*need for additional training*" was 1.150 that was below the critical value *F* for

α=.05 for degree of freedom (*df*) of 4 and 17 is $F_{.05}(4,17)= 2.96$. Other disadvantages *F* values were not higher than the critical value of *F* in its comparative degree of freedom. Using analysis of variance, there was no significant correlation between respondents' teaching styles and their perceptions on advantages of mobile computing (Appendix 11).

Second, data of significant correlations between technology adoption stages and advantages were presented from "*Entry*" to "*Invention*" stage. Respondents' selection of "*Entry*" and "*Adoption*" technology adoption stages as representing their own stages had no significant correlation with either their perception of advantages or their perception of disadvantages of mobile computing. The correlation between "*Adaptation*" technology adoption stage and advantage "*improve data collection in the field*" was significant $r = .421$. The positive correlation meant that the higher the respondents rated themselves this technology adoption stage, the higher they rated the advantage "*improve data collection in the field.*"

The correlation between "*Appropriation*" technology adoption stage and advantage "*improve professor-student communication*" was significant $r = .395$. The positive correlation meant that the higher the respondents rated themselves on this technology adoption stage, the higher they would rate the advantage "*improve professor-student communication.*"

The correlation between "*Invention*" technology adoption stage and advantage "*increase efficiency and organization*" was significant $r = .402$. The

positive correlation meant that the higher respondents rated themselves on this technology adoption stage, the higher they would rate the advantage "*increase efficiency and organization.*" The correlation between respondents' "*Invention*" technology adoption stage and advantage "*increase enthusiasm for teaching*" was significant $r = .489$. The positive correlation meant that the higher respondents rated themselves on this technology adoption stage, the higher they rated the advantage "*increase enthusiasm for teaching.*"

Null Hypothesis 3, "*respondents' stages of technology adoption do not correlate with their perceptions on the advantages of mobile computing*" was partially rejected because there were some significant correlations between respondents' technology adoption stage and their perception of advantages of mobile computing. However, Null Hypothesis 3 was partially accepted because no significant correlation was found between respondents' technology adoption stage and their perception of the disadvantages of mobile computing. Table 19 and Figure 32 show the correlation between respondents' technology adoption stage and their perception of advantages of mobile computing.

Table 19. Pearson *r* correlation between respondents' technology adoption stage and their perception of advantages and disadvantages of mobile computing

Technology Adoption Stage	Advantages	Pearson r	Significant
Entry	All advantages	Varied	Not significant
Adoption	All advantages	Varied	Not significant
Adaptation	"improve data collection in the field"	0.421	(*)
Appropriation	"improve professor-student communication"	0.395	(*)
Invention	"increase efficiency and organization"	0.402	(*)
Invention	"increase enthusiasm for teaching"	0.489	(*)

(*) Correlation is significant at the 0.05 level (2-tailed).

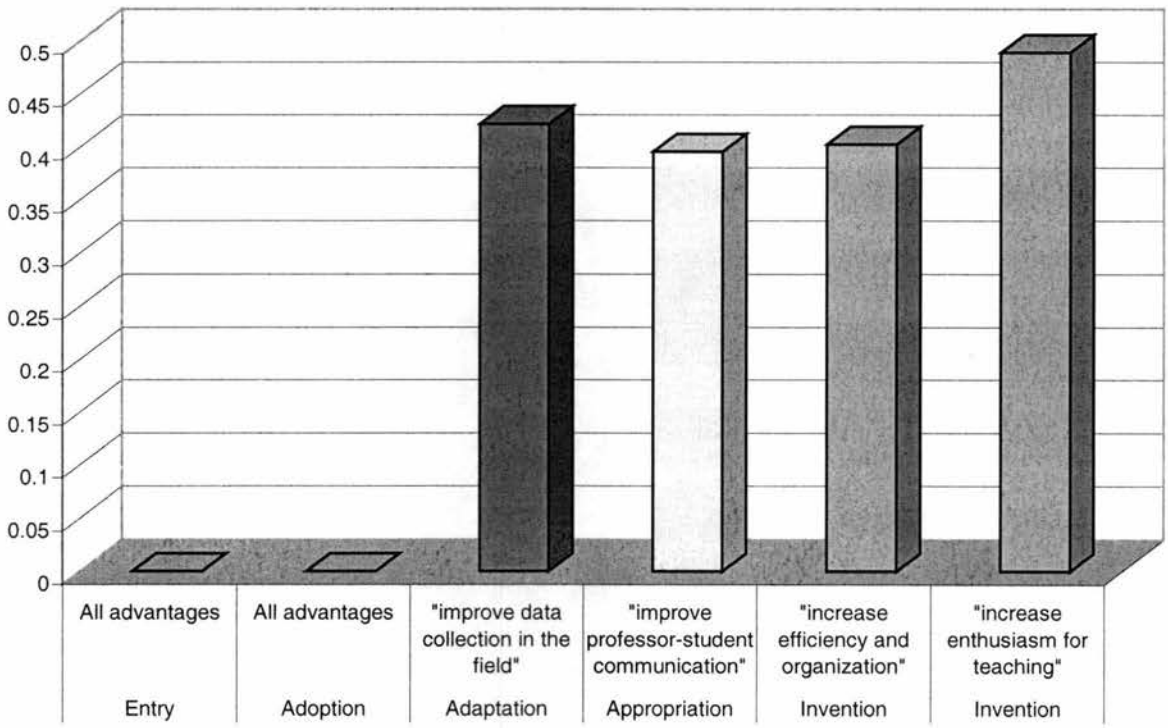


Figure 32. Significant Pearson *r* correlation scores between respondents' technology adoption stage and advantages

Mean plots of advantages and disadvantages showed the line above or equal to 2.5 that means agreed with the the advantages and disadvantages of mobile computing. Respondents who chose "*Invention*" stage disagreed with the advantages "*better record keeping*" and "*improve data collection in the field.*" Those who chose "*Adoption*" disagreed with "*collaboration in a common experience.*" Other respondents agreed with all advantages. Figure 33 summarizes the respondents' agreement rate on advantages of mobile computing.

All respondents agreed with disadvantage "*lack of time for personal activities.*" Respondents who chose "*Adaptation*" and "*Appropriation*" stages agreed with three disadvantages. Those who chose "*Entry*" and "*Invention*" agreed with two disadvantages. Figure 34 shows the respondents' agreement rate on disadvantages of mobile computing.

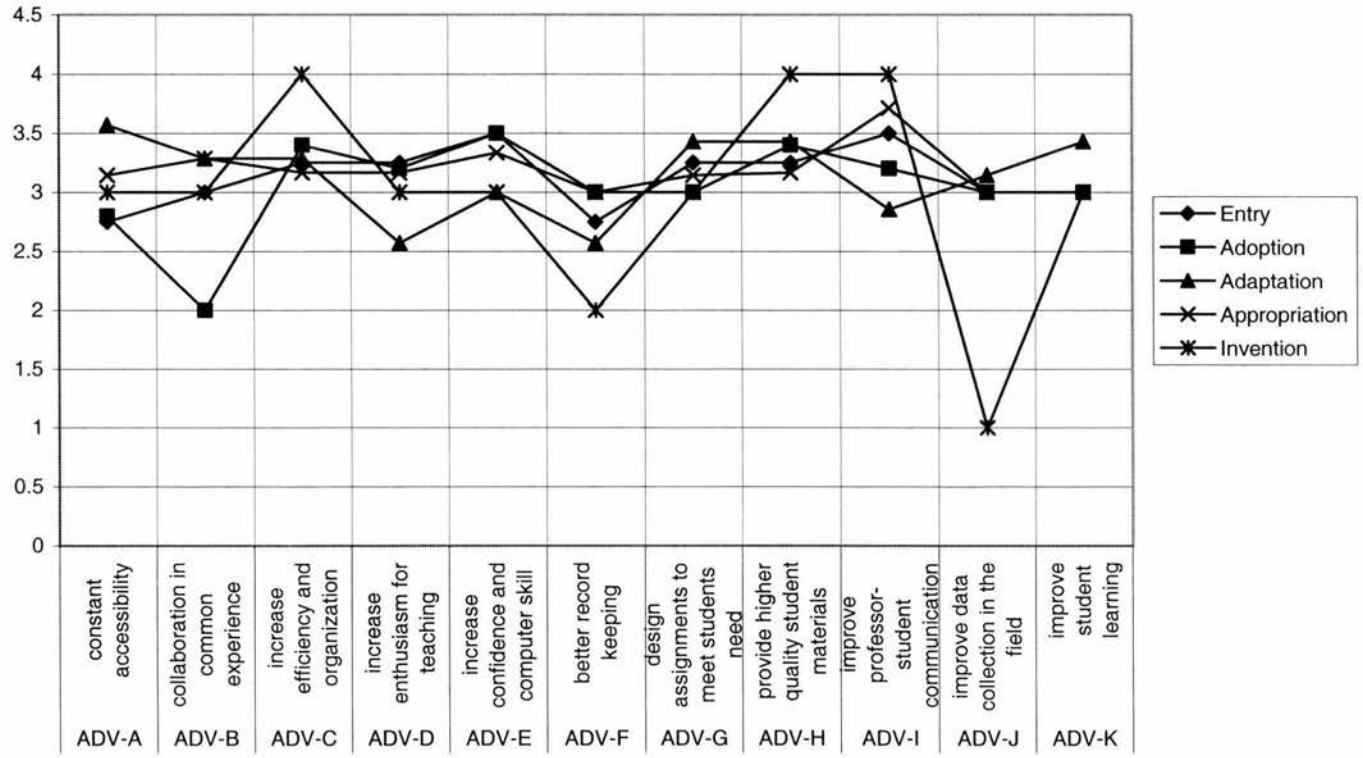


Figure 33. Meanplots of respondents' technology adoption stages and advantages of mobile computing (above 2.5 indicates agreement)

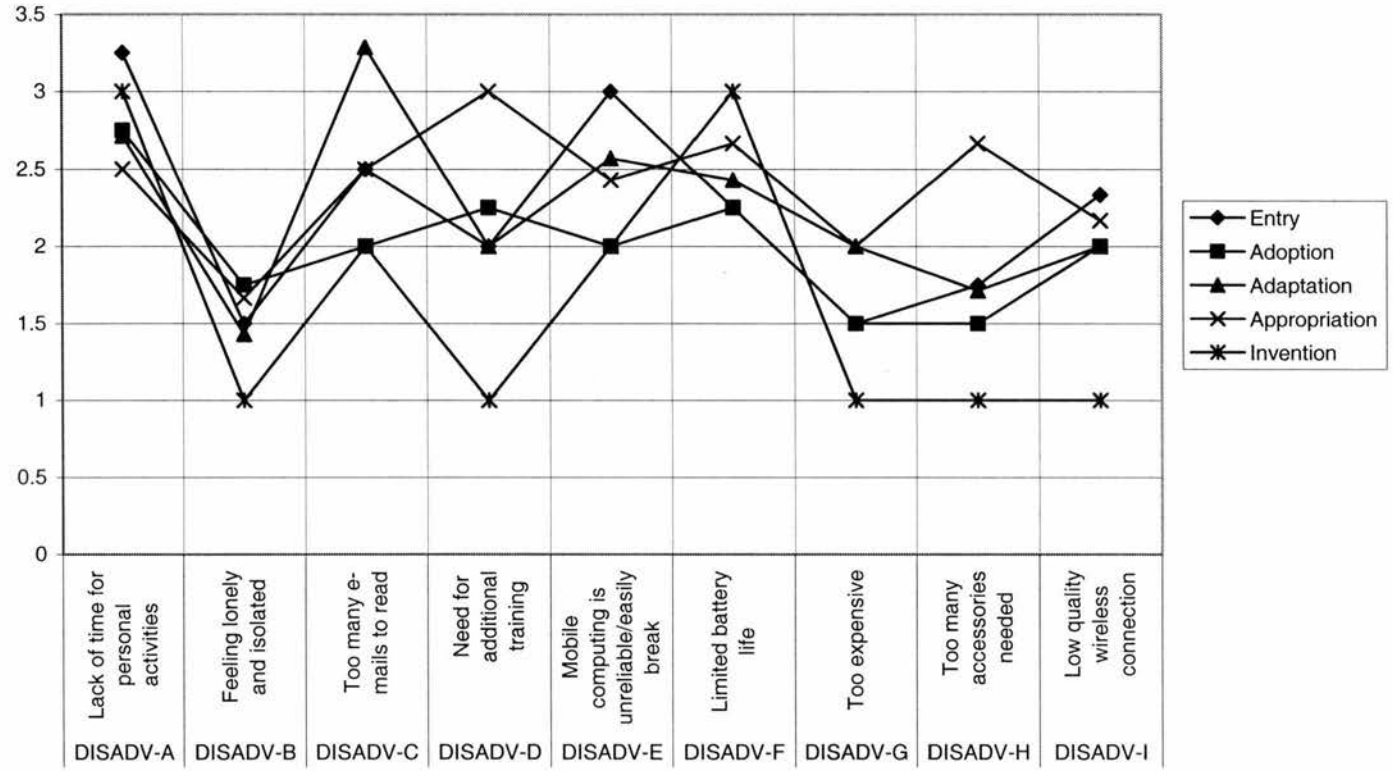


Figure 34. Meanplots of respondents' technology adoption stages and disadvantages of mobile computing (above 2.5 indicates agreement)

Hypothesis 4: Testing the correlation between respondents' mobile computer use and their perception of advantages and disadvantages of mobile computing

In this section, the respondents' perceptions were divided into two groups: advantages and disadvantages. The findings are presented in two sections: first, the correlation between respondents' mobile computer use in the classroom and advantages; second, the correlation between respondents' mobile computer use in the classroom and disadvantages.

Respondents' mobile computer use in the classroom and advantages

Null Hypothesis 4 was "*respondents' mobile computer use does not correlate with their perceptions on the advantages and disadvantages of mobile computing.*" In this section, the correlation of respondents' mobile computer use in the classroom and advantages of mobile computing was investigated using analysis of variance (ANOVA) and Pearson *r* correlation. There were five levels of mobile computing use: (a) less than 5%, (b) between 6%-25%, (c) between 26%-50%, (d) 51%-75%, and (e) more than 75% of respondents' class time (Appendix 2, question number 7).

Respondents were asked to rate from 1 for agree to 4 for disagree to 11 advantage statements on the survey question number 13. Analysis of variance was employed to compare means of respondents' agreement rate based on respondents' five levels of mobile computer use in the classroom. Appendix 8 shows that *F* for advantage "*constant accessibility*" is $F(4, 25) = .782$, with *df* for the numerator is 4 and *df* for the denominator is 25. The *F* score output is not

bigger than the critical values for $\alpha = 0.05$ and $\alpha = 0.01$ for degree of freedom (*df)* of 4 and 25 are $F_{0.05}(4,25) = 2.76$ and $F_{0.01}(4,25) = 4.18$ respectively. This means that there was no significant correlation between mobile computer use in the classroom and advantage "*constant accessibility.*" The rule applies to other ten advantages. The *F* score of each advantage must above $F_{.05} = 2.76$ or $F_{.01} = 4.18$ to be considered significant. In fact, none of the advantages reached *F* score more than the *F* table suggested (Appendix 12).

Using Pearson *r* correlation analysis, the correlation of mobile computer use in the classroom with the advantages and disadvantages was investigated. There were three significant correlations: two with the advantages and one with a disadvantage of mobile computing. The correlation of "*Using mobile computer less than 5% of class time*" and advantage "*improve student learning*" was significant $r = -.371$. Negative correlation meant that the professors rated themselves on the "*Using mobile computer less than 5% of class time*," the lower they rated the advantage "*improve student learning.*"

The correlation of "*Using mobile computer between 26%-50% of class time*" and advantage "*increase enthusiasm for teaching*" was significant $r = .374$. The positive correlation meant that the higher the professors rated themselves on "*Using mobile computer between 26%-50% of class time*," the higher they rated the advantage "*increase enthusiasm for teaching.*"

Therefore, Null Hypothesis 4 is rejected. Respondents' teaching methods did correlate with their perceptions on the advantages. Therefore, the study

rejected Null Hypothesis 4 and concluded that there were significant correlations between respondents' mobile computer use in classroom and respondents' perception of the advantages of mobile computing.

The mean plots showed that some respondents who used mobile computer in the classroom agreed with some of the advantages that were listed on the survey. Agree means their mean score was above 2.5 for a Likert scale between 1 for disagree and 4 agree. All respondents from five groups of mobile computer use in the classroom agreed with advantage "*constant accessibility*," "*provide higher quality student materials*," "*improve professor-student communication*," and "*improve student learning*." Table 20 shows respondents' mobile computer use in the classroom and their perceptions of the advantages of mobile computing.

Table 20. Respondents' mobile computer use (% of class time) and their agreement/disagreement of the advantages of mobile computing.

Mobil computer use in the classroom	Disagree	Agree
"Less than 5% of class time"	(1) "collaboration in common experience," (2) "increase efficiency and orgnization," (3) "increase enthusiasm for teaching," (4) "better record keeping," (5) "design assignments to meet students need," and (6) "improve student learning."	(1) "constant accessibility," (2) "increase confidence and computer skill," (3) "provide higher quality student materials," (4) "improve professor-student communication," and (5) "improve data collection in the field."
"Between 6%-25%"	"(1) increase enthusiasm for teaching" and (2) "better record keeping,"	(1) Constant accessibility, (2) Collaboration in a common experience, (3) Increase efficiency and organization, (4) Increase confidence and computer skill, (5) Design assignments to meet student needs, (6) Provide higher quality student materials, (7) Improve professor-student communication, (8) Improve data collection in the field, (9) Improve student learning
"Between 26%-50%"	None	All of 11 advantages
"Between 51%-75%"	(1) Collaboration in common experience, and (2) Better record keeping	(1) Constant accessibility, (2) Increase efficiency and organization, (3) Increase enthusiasm for teaching, (4) Increase confidence and computer skill, (5) Design assignments to meet student needs, (6) Provide higher quality student materials, (7) Improve professor-student communication, (8) Improve data collection in the field, (9) Improve student learning
"More than 76%"	(1) Increase confidence and computer skill, and (2) Improve data collection in the field	(1) Constant accessibility, (2) Collaboration in a common experience, (3) Increase efficiency and organization, (4) Increase enthusiasm for teaching, (5) Better record keeping, (6) Design assignments to meet student needs, (7) Provide higher quality student materials, (8) Improve professor-student communication, (9) Improve student learning

Figure 35 shows the combine mean plots of respondents' perception of advantages of mobile computing based on their use of mobile computing in the classroom.

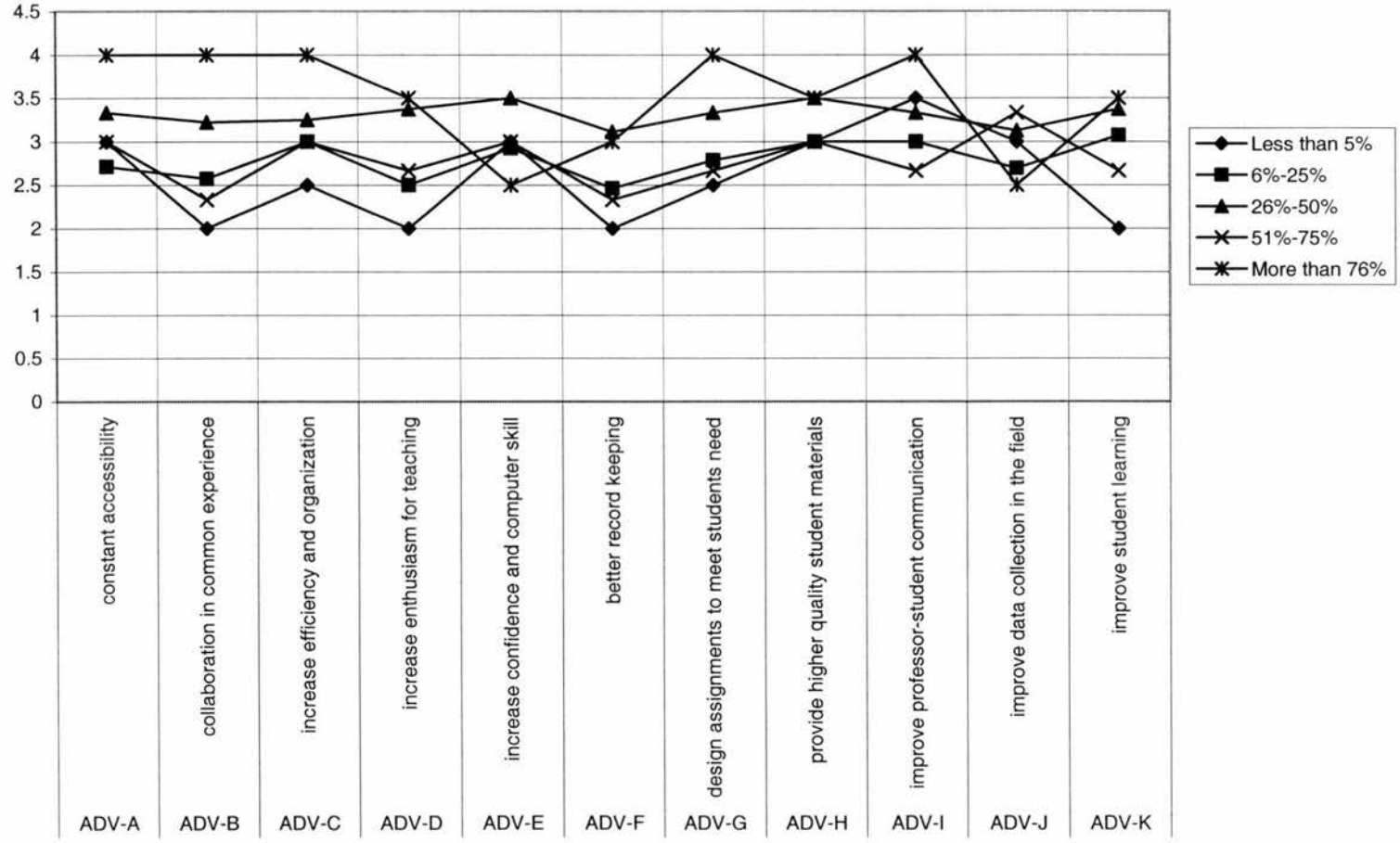


Figure 35. Mean plots of respondents' agreement rate on the advantages of mobile computing based on their mobile computer use in the classroom (above 2.5 indicates agreement).

Respondents' mobile computer use in the classroom and disadvantages

Null Hypothesis 4 was "*respondents' mobile computer use does not correlate with their perceptions on the advantages and disadvantages of mobile computing.*" In this section, the correlation of respondents' mobile computer use in the classroom and disadvantages of mobile computing was investigated using analysis of variance (ANOVA). There were five levels of mobile computing use: (a) less than 5%, (b) between 6%-25%, (c) between 26%-50%, (d) 51%-75%, and (e) more than 75% of respondents' class time (Appendix 2, question number 7).

Respondents were asked to rate from 1 for agree to 4 for disagree to nine disadvantage statements on the survey question number 15. Analysis of variance was employed to compare means of respondents' agreement rate based on respondents' five levels of mobile computer use in the classroom. Appendix 13 shows *F*-table of analysis of variance of mobile computer use in the classroom and respondents' perceptions of disadvantages of mobile computing. To be cosidered as a significant correlation, the *F* score of every disadvantages must be above the critical values for $\alpha = .05$ and $\alpha = .01$ for degree of freedom (*df)* of 4 and 22 that were $F_{.05}(4,22) = 2.82$ and $F_{.01}(4,22) = 4.31$ respectively. The highest *F* score was 2.200 for disadvantage "*feeling lonely and isolated*" but the score was not bigger than critical *F* score to be considered as a significant correlation.

Using Pearson *r* correlation analysis, the correlation of "*Using mobile computer between 51%-75% of class time*" and disadvantage "*feeling lonely and isolated*" was significant $r = .516$. The positive correlation meant that the professors who chose "*Using mobile computer between 51%-75% of class time*" rated high or agreed with this disadvantage. Therefore, Null Hypothesis 4, "*respondents' mobile computer use does not correlate with their perceptions on the disadvantages of mobile computing*," was rejected.

The mean plots showed that some respondents who used mobile computer in the classroom agreed with some of the disadvantages that were listed on the survey. Agree means their mean score was above 2.5 for a Likert scale between 1 for disagree and 4 agree. Respondents who used mobile computer less than 5% of class time agreed with disadvantages "*need for additional training*" and "*mobile computing is unreliable/easily break.*" Respondents in this group disagreed with the other seven disadvantages.

Respondents who used mobile computer between 6%-25% of class time agreed with one disadvantage: "*mobile computing is unreliable/easily break.*" Respondents in this group disagreed with the other eight disadvantages.

Respondents who used mobile computer between 26%-50% of class time agreed with the three disadvantages: "*lack of time for personal activities*," "*too many e-mails to read*," and "*limited battery life.*" Respondents in this group disagreed with the other six disadvantages.

Respondents who used mobile computer between 51%-75% of class time agreed with six disadvantages of mobile computing: (1) "*lack of time for personal activities*;" (2) "*feeling lonely and isolated*;" (3) "*too many e-mails to read*;" (4) "*need for additional training*;" (5) "*limited battery life*;" and (6) "*too many accessories needed*." They disagreed with the three disadvantages: "*mobile computing is unreliable/easily break*," "*too expensive*," and "*low quality wireless connection*." Figure 36 shows the combine mean plots of respondents' perception of disadvantages of mobile computing based on their use of mobile computing in the classroom.

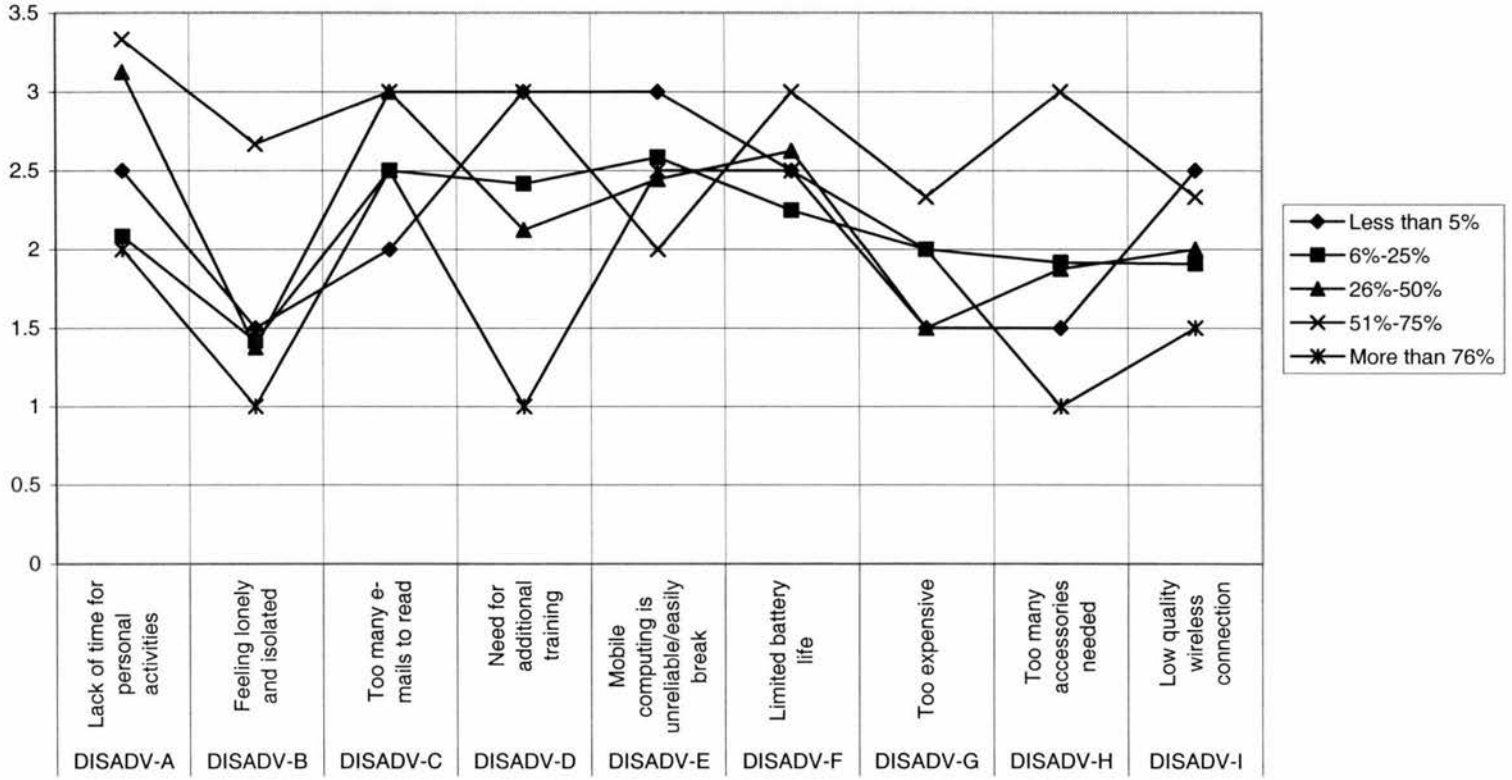


Figure 36. Mean plots of respondents' agreement rate on the disadvantages of mobile computing based on their mobile computer use in the classroom (above 2.5 indicates agreement)

Summary of the correlation between mobile computer use in the classroom and the advantages and disadvantages of mobile computing

Null Hypothesis 4 was rejected because there was significant correlations between respondents' mobile computer use in the classroom and their perceptions of the advantages and disadvantages of mobile computing. Table 21 and Figure 37 show the comparison of three significant Pearson r correlation scores.

Table 21. Pearson r correlation between respondents' mobile computer use and the advantages and disadvantages of mobile computing.

Mobile computer use (% of class time)	Advantages/Disadvantages	Pearson r	Significant
Less than 5%	"improve student learning"	-0.371	(*)
26%-50%	"increase enthusiasm for teaching"	0.374	(*)
51%-75%	"feeling lonely and isolated"	0.516	(**)
(*) Correlation is significant at the 0.05 level (2-tailed). (**) Correlation is significant at the 0.01 level (2-tailed).			

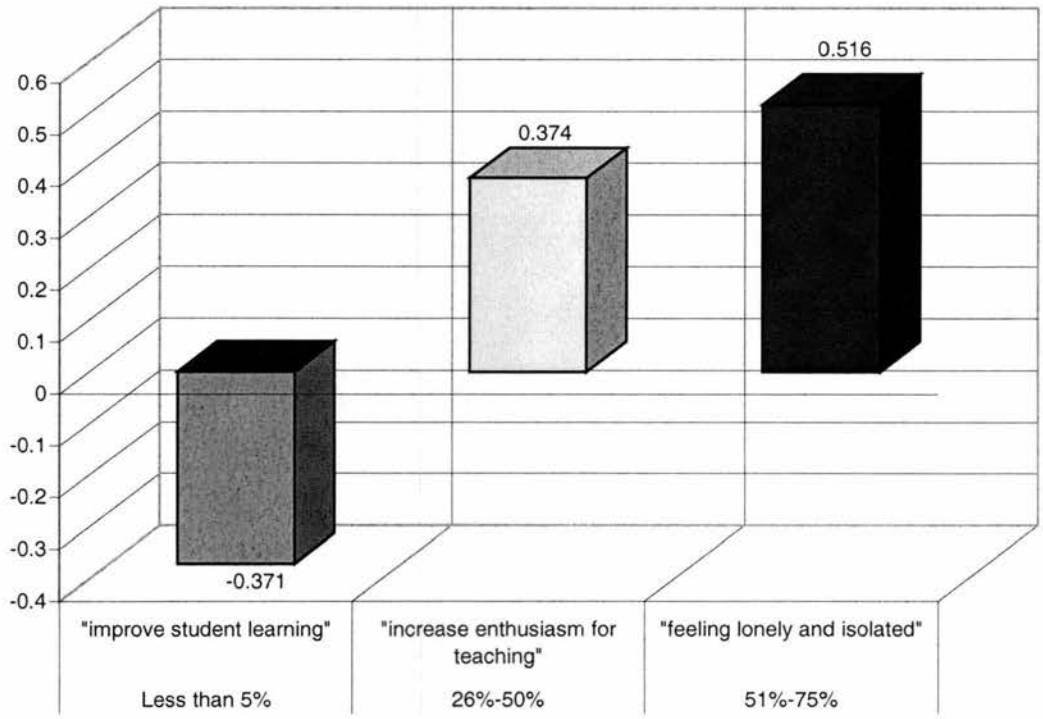


Figure 37. Pearson *r* correlation of respondents' mobile computer use and two advantages and one disadvantage of mobile computing.

Conclusion of hypotheses testing

There were some significant correlations between respondents' teaching methods and their perceptions of advantages and disadvantages of mobile computing. Respondents' "*Lecture*," "*Discussion*," and "*Students work on project*" teaching methods were correlated significantly with three advantages and one disadvantage of mobile computing (Figure 27). Therefore, Null Hypothesis 1, "*respondents' teaching methods do not correlate with their perceptions on the advantages and disadvantages of mobile computing*" was rejected.

There were some significant correlations between respondents' teaching styles and their perceptions of the advantages of mobile computing (Table 18 and Figure 29). Respondents' "*Personal Model*," "*Expert*," "*Formal Authority*," "*Facilitator*," and "*Delegator*" teaching styles were correlated significantly with eight advantages. Therefore, Null Hypothesis 2, "*respondents' teaching styles do not correlate with their perceptions of the advantages and disadvantages of mobile computing*" was rejected. However, there was no siginificant correlation between respondents' teaching styles and their perceptions on the disadvantages of mobile computing. Therefore, Null Hypothesis 2, "*respondents' teaching styles do not correlate with their perceptions of the disadvantages of mobile computing*" was accepted.

There were also some significant correlations between respondents' technology adoption stages and their perceptions on the advantages of mobile computing (See Table 19 and Figure 32). Respondents' "*Adaptation*," "*Appropriation*," and "*Invention*" technology adoption stages were correlated significantly with four advantages. Therefore, Null Hypothesis 3, "*respondents' stages of technology adoption do not correlate with their perceptions on the advantages and disadvantages of mobile computing*" was rejected. However, in term of disadvantages, Null Hypothesis 3 was accepted because there was no significant correlation between respondents' technology adoption stages and their perception of the disadvantages of mobile computing.

There was some significant correlations between respondents' mobile computer use in the classroom with their perceptions on the advantages and disadvantages of mobile computing (Table 21 and Figure 37). Respondents' mobile computer use "*Less than 5% of class time*," "*Between 26%-50% of class time*," and "*Between 51%-75% of class time*" were correlated significantly with two advantages and one disadvantage. Therefore, Null Hypothesis 4, "*respondents' mobile computer use does not correlate with their perceptions on the advantages and disadvantages of mobile computing*" was rejected. Table 22 shows the results of hypotheses testing on teaching methods, teaching styles, technology adoption stages, and mobile computer use in the classroom with perceptions of advantages and disadvantages of mobile computing.

Table 22. The results of hypotheses testing on four Null Hypotheses of the advantages and disadvantages of mobile computing.

Null Hypothesis		Advantages	Disadvantages
1	"Respondents' *teaching methods* do not correlate with their perceptions on the advantages and disadvantages of mobile computing"	**YES (rejected)**	**YES (rejected)**
2	"Respondents' *teaching styles* do not correlate with their perceptions on the advantages and disadvantages of mobile computing"	**YES (rejected)**	NO (accepted)
3	"Respondents' *stages of technology adoption* do not correlate with their perceptions on the advantages and disadvantages of mobile computing"	**YES (rejected)**	NO (accepted)
4	"Respondents' *mobile computer use* do not correlate with their perceptions on the advantages and disadvantages of mobile computing"	**YES (rejected)**	**YES (rejected)**

Section 2.1: Case Studies

In addition to the survey in the first phase of the study, this research also included a series of case studies composed of both interviews and classroom observations. The purpose of this case study was to elaborate further and triangulates the survey results. In particular, interviews with participants provided an opportunity for them to explain their teaching methods, their teaching styles, and their perceptions on the advantages and disadvantages of mobile computing. Classroom observations provided additional data source on participants' use of mobile computing in their classrooms as well as their technology adoption stage. The interviews also afforded participants opportunities to dismiss the criteria of postmodernism professionalism.

Table 23. Case Study Presentation

Phase 2	- Prof. A - Prof. B - Prof. C - Prof. D - Prof. E	The report presented the cases based on participants': (1) Teaching method, (2) Teaching style, (3) Technology adoption stage, (4) Mobile computing use in the classroom, (5) Advantages/disadvantages, (6) Pattern of computer use: weekdays and weekends. (7) Post-modernism professionalism perceptions.

Five professors volunteered to be participants in the case study. In this phase, each professor made time for interviews and classroom observations.

The professor also submitted the syllabus for his or her course. In sum, four data sources were utilized to build each case study for each professor: (1) the professor's survey result in the first phase; (2) interviews; (3) classroom observations; and (4) syllabus.

Each professor was interviewed twice and observed in his or her classroom three times (Table 20). In this second phase of the study, each participant picked the dates and times for the interviews and classroom observations that were convenient for them. The interviews and observations occurred during the fall, 2003 semester. The interviews varied in length, from 27 minutes to 62 minutes. Classroom observations varied depending upon the courses, ranging from one hour to three hours. The classroom observations were conducted thoroughly for each class from the beginning to the end of the class.

Table 24. The dates of 25 visits to participants of case study during fall 2003 semester

Participants	Interviews		Observations		
	First	Second	First	Second	Third
Prof. A	18-Sep	8-Dec	29-Sep	22-Oct	8-Dec
Prof. B	30-Sep	2-Dec	7-Oct	22-Oct	9-Dec
Prof. C	11-Sep	4-Dec	18-Sep	23-Oct	4-Dec
Prof. D	29-Sep	5-Dec	30-Sep	7-Nov	2-Dec
Prof. E	25-Sep	30-Nov	25-Sep	1-Nov	20-Nov

Case Studies and The Main Research Question

The main research question was "*what do college professors perceive to be the pedagogical advantages and disadvantages of mobile computing in*

courses that require its use by students?" The survey and quantitative analysis have described some findings useful in answering the main research question. The case study provided additional information about the professors' teaching methods, teaching styles, technology adoption stage as defined by a 10-year study of Apple Classroom of Tomorrow (ACOT) and the degree to which the ACOT stages map to higher education, and mobile computing use in their classroom.

Data collected in interviews described professors' thoughts on the impact of mobile computing on their teaching and learning activities. A common notion at the time of this study was that mobile computing could allow professors to work 24 hours and seven days a week, or "*24/7*" , constantly reading and responding to e-mails from students and colleagues, and at the same time keeping up with new developments in their discipline by joining professional and academic associations. Hargreaves and Goodson (1996) offered a term called "post-modernism professionalism" that includes seven principles:

1. Increased opportunity and responsibility to exercise discretionary judgment over the issues of teaching, curriculum and care that affect one's students.
2. Opportunities and expectations to engage with the moral and social purposes and value of what teachers teach, along with major curriculum and assessment matters in which these purposes are embedded.

3. Commitment to working with colleagues in collaborative cultures of help and support as a way of using shared expertise to solve the ongoing problems of professional practice, rather than engaging in joint work as a motivational device to implement the external mandates of others.
4. Occupational heteronomy rather than self-protective autonomy, where teachers work authoritatively yet openly and collaboratively with other partners in the wider community, especially parents and students themselves, who have a significant stake in the students' learning.
5. A commitment to active care and not just routine service for students. Professionalism must in this sense acknowledge and embrace the emotional as well as the cognitive dimensions of teaching, and also recognize the skills and dispositions that are essential to committed and effective caring.
6. A self-directed search and struggle for continuous learning related to one's own expertise and standards of practice, rather than compliance with the enervating obligations of endless change demanded by others, which Hargraeves & Goodson claimed, often occurs under the guise of continuous learning or improvement.
7. The creation and recognition of high task complexity, with levels of status and reward appropriate to such complexity.

For the purpose of this case study, those seven principles are coded as "principle #1," "principle #2," and so on, through "principle #7." These principles are

compared with each professor's observable behaviors, thoughts, or values in the survey, interviews, observations, and syllabus for matches with all or some of the seven principles.

Each case study was developed utilizing data from three classroom observations, two interviews, and some additional information, such as syllabus and e-mail communications with the participants. The professors who volunteered to participate in the second phase of study taught different courses, had different personalities, experience, and areas of expertise. However, the research questions and consistent attention to the variables of the study -- professor's teaching style, teaching method, and technology adoption stage, mobil computer use in the classroom, and the professor's perceptions on the advantages and disadvantages of mobile computing -- provided a standard outline for all five participants. Nevertheless, the case study was open to findings outside of the variables of the study.

The interviews and classroom observations produced text-based data that were analyzed further by coding the data. The coding process used theory-based and themes approach. Theory-based approach was used to assess participants' teaching style and technology adoption stage, and participants' post-modernism professionalism. Theme approach was used for participants' perception on mobile computing such as pedagogical advantages and disadvantages. The study employed Folio Views 4.0 and N-Vivo for qualitative data analysis.

Participants' Teaching Methods

Five participants chose among four different teaching methods in the survey questionnaire number 7 (Appendix 2). Three participants (Professor A, B, and C) selected "*Students work on projects*" as the teaching method that they deemed best represented their own methods. Professor D selected "*Other/All of them*." Professor E selected "*Discussion*" teaching method as best representing his or her teaching method. Table 25 shows professor's teaching methods based on their response to the survey.

Table 25. Five professors' teaching methods in the survey

Professor	Teaching Method
A, B, and C	*Students work on projects*
D	*Other/All of them*
E	*Discussion*

Note: Figure 7 in the survey result section provides the composition of 30 respondents' teaching method.

The case study included the comparison of the five participants' responses in the survey in phase one with classroom observations and interviews with the participants to yield a more complete understanding of their methods. Despite the choices selected by the participants, the observations revealed that the methods in the classroom settings were in fact dominated by "*Lecture*" teaching method. However, there was variation in how the participants complemented their lectures with other teaching methods, and the

complementary activities comprised qualifications of the observed teaching methods.

Professor A's Teaching Method

In the survey, professor A chose age group between 51-60 years old and had been teaching for more than 21 years. The professor had been using computer for 15 years and chose teaching method "*Students work on projects*." The professor started using mobile computer three years ago. Professor A applied "*Students work on projects*" teaching method because the professor thought this was the most important part of the course rather than other methods, such as "*Lecture*" and "*Discussion*," that also occupied class time. Professor A assigned students to form groups and then worked on projects. In fall 2003 semester, Professor A's class met Mondays and Wednesdays or two times a week. Each class met for 50 to 60 minutes depending upon the session of the day. On Mondays, the professor taught the course in a computer lab. This was the time for the professor to help students to catch up with the materials and especially assignments and projects. "*The Monday lab rounds out [complement] things if in the classes before students couldn't do their work*," the professor reported after the first classroom observation (Personal communication, September 18, 2003).

Professor A's response in the survey was compared to three classroom observations conducted during the fall 2003 semester. The duration of the first class was 79 minutes, when professor A lectured for 39 minutes or 49% of the

class time and used 40 minutes or 51% of class time for consulting or helping students with their projects. Twenty-one students attended the class, none of them brought laptop computer. The professor wrote a list of activities for the day on the blackboard and asked students to work according to the list. The professor who kept talking and giving instructions to students was rarely using desktop computer and LCD projector. Students used desktop PCs that were available for each of them to use for working on the assignments and making spreadsheets.

The duration of Professor A's second class was 48 minutes, when the professor used 44 minutes or 92% of class time for lecturing and four minutes for helping students. Sixteen students attended the class, eight of them brought laptops. In this session, professor A used overhead projector and one transparency for the whole class time. The students used their wireless laptops and opened Microsoft Excel application for completing the assignment and class exercises, while Professor A was lecturing and explaining the topics and exercises.

The duration of the third class was 120 minutes, when the professor was helping students or consulting for 113 minutes or 94% of class time and the remaining 6% for lecturing. Twelve students attended the class and none of them brought laptops. Professor A wrote a list of assignments that students must submit that day on a blackboard in the front of the classroom. The professor did not use the desktop computer in the teacher's desk and also did not bring a

laptop. Students used desktop PCs that were available to them for use in completing the assignments and final project.

The classroom observations showed that professor A used 51% of class time for helping students work on their projects. This finding was consistent with the professor's favorite teaching method in the survey that was "*Students work on projects*" where the professor was consistently helping students in doing group projects in addition to individual exercises, homework, three tests, and on-line quizzes. In an interview, professor A said: "*They had to do a presentation for projects that they were working on during the semester so they had to have the laptop and I provided them with an LCD projector so that they are able to do the presentation to the class*" (Personal communication, September 18, 2003).

Professor A's syllabus described that the students were required to complete an assignment in teams of four that would design and produce a product at the end of the semester. According to the syllabus, students will apply managerial accounting concepts and theories as they work on their business plan and design their product. Professor A also stated the deadlines of important assignments on the syllabus, such as the drafts of business plan and product design that were due during the semester and the completed team business plan project, including classroom presentation, written report, and evaluation, that was due on Monday, December 1, 2003. Three observed class meetings demonstrated that professor A practiced "*Students work on projects*" teaching method because on average of three observed class meetings, the professor

practice it for 51% of class time, more than "*Lecture*" method that was practiced for 47.3% of class time. Table 26 shows professor A's teaching method in three observations.

Table 26. Professor A's teaching method in three observed class meetings.

Prof. A	Method (% of class time)	
Classroom observation	Lecture	Students work on projects
1	**49**	**51**
2	**92**	**8**
3	**6**	**94**

Professor B's teaching method

In the survey, professor B chose age group between 51-60 years old and had been teaching for 11-15 years. The professor had been using computer for 18 years and chose teaching method "*Students work on projects.*" Professor B applied "*Students work on projects*" teaching method because the professor believed the students would be able to understand the course materials better by doing projects that were suited for them. In fall 2003, Professor B's class met Tuesdays and Thursdays or two times a week. Each class met for 105 to 115 minutes depending upon the session of the day. The first thing the professor did in starting the class was to check students' understanding of the previous class, incoming assignments, exercises, or projects. The professor called this initial section of each class meeting "housekeeping."

The survey response was compared to the three classroom observations conducted during the fall 2003 semester. The duration of the first class was 95

minutes, when professor B lectured for 86 minutes or 90.5% of the class time and used remainder of the class time for other activities, such as questions and answers, and handout distribution. Twenty-two students attended the class. Fourteen of them brought wireless laptop computers. The professor used Power Point presentation for class lecture, Internet browser for class web site on Blackboard.com, positive slide projector for showing pictures or photographs, and overhead projector for text or image on a transparency. Students used wireless laptop computer for visiting web sites suggested by the professor, working on on-line pop-quiz, and downloading course materials from the class web site.

The duration of the second class was 107 minutes, when the professor used 50 minutes or 46.7% of class time for lecturing, but let the students present some of their projects to the class and had a question and answer session for 57 minutes or 53.2% of the class time. Eighteen students attended the class, and 12 of them brought laptops. Professor B used Power Point for the whole class lecture and no positive slide projector or transparency. Professor B did not show photographs or transparency because those materials were already scanned into the Power Point slides. Students used wireless laptop computers for visiting web sites suggested by the professor and downloading course materials from the class web site.

The duration of the third class was 104 minutes, when the professor was lecturing for 56 minutes or 54% of class time and asked three students to present

their projects for almost 27 minutes or 26% of class time, and the rest for questions and answers. Twenty-three students attended the class, only two of them brought and used laptops. The two students used the laptop for working on their assignments on wordprocessor and did not use it for browsing, chatting, or e-mailing. Professor B explained to students that lecturing took big portion of class time that day because the third classroom observation was almost at the end of the semester and the professor thought that the students had not had all the material in the course. Again, the professor used Power Point presentation for class lecture, Internet browser for class web site on Blackboard.com, positive slide projector for showing pictures or photographs, and overhead projector for text or image on a transparency. "Ready? Take a deep breath," the professor said after each round of lecture with Power Point presentation. The classroom observation showed that during the three observations, Prof. B used approximately 63% of class time for lecturing.

In an interview, the professor said:

> "*Basically after lecturing, and after conversing back and forth, with give and take discussion, we literally work on individual projects based on the learning concept in the classroom*" (Personal communication, December 2, 2003).

Professor B's syllabus stated that students read, researched, produced oral, written, and visual presentations; attended lectures and participated in class discussions; analyzed artworks, including slides and movies, and visited museums and collections to examine additional objects. The observed class meeting showed that the professor did the classroom activities in conjunction

with student projects. However, three observed class meetings showed that professor B practiced "*Lecture*" teaching method on average 63.7% off class time and other methods, such as "*Students work on projects*" for the remaining 36.3% (Table 27).

Table 27. Professor B's teaching method in three observed class meetings.

Prof. B	Method (% of class time)	
Classroom observation	Lecture	Students work on projects
1	**90.5**	**9.5**
2	**46.7**	**53.3**
3	**54**	**46**

Professor C's teaching method

In the survey, professor C chose age group between 51-60 years old and had been teaching for 11-15 years. The professor had been using computer for 30 years, and started using mobile computer seven years ago. Professor C also chose teaching method "*Students work on projects.*" Professor C applied "*Students work on projects*" teaching method because the professor supposed the students needed learning experience that was similar to the real workplace condition. The professor assigned students to visit web sites that were related to the course and wrote a response paper about it.

The length of first observed class meeting was 109 minutes, the second one 112 minutes, and the third one 100 minutes. The professor conducted lecture in each of those classes: 31 minutes or 28% of class time, 29 minutes or 26%, and 48 minutes or 48% respectively (Table 28).

Table 28. Professor C's teaching method during three observed class meetings.

Prof. C	Method (% of class time)	
Classroom observation	Lecture	Students work on projects
1	**28**	**72**
2	**26**	**74**
3	**48**	**52**

The major activity in the first observation was consulting or assistance for 52 minutes or 48% of class time. Twenty-two students attended the class. All of them brought and used wireless laptop computers. Professor C used desktop computer that was available on the teacher's desk. The professor used Power Point for class lecture, discussion, and group projects. The professor also used Internet browser to show class web site and to show some web sites that were useful for the class. Students used wireless laptop computers for visiting web sites suggested by the professor and working on class exercises. The exercise was students work in groups to produce a project related to the course content. They must present their work in the end of the class on a 5-minute Power Point presentation. Twenty-two students were divided into four groups. All groups presented their work in the end of the class and each group took a unique perspective in its public relation campaign.

The major activity in second observation was students work on group projects for 36 minutes or 32% of class time. Professor C used desktop computer at the teacher's desk and used some Power Point slides to guide the students. Twenty students attended the class. All of them brought and used

laptops. Students used wireless laptop computers for visiting web sites suggested by the professor and working on class exercise. The exercise of the day was students working in groups to models they had studied. The students used the leadership models available on a CD-ROM from the required textbook, worked in groups, and then presented their cases to the class with a Power Point presentation. Professor C explained to the class that the exercise was important to help them make sense of the real world using the models. The students could not complete the exercise by the end of the class. The professor asked the students to put their finished works into classroom folder on course web site by the weekend and required them to give presentation next week.

The major activity in third observation was lecture for 48 minutes or 48% of class time. The classroom observations showed that Professor C used lecture one third of the time, and a variety of teaching methods, such as group discussion, group project, e-meeting, and consulting the remainder of the time. Eighteen students attended the class, nine females and nine males, and all of them brought laptops. The professor used the desktop PC in the teacher's desk and show some Power Point slides and Internet browser to clarify class assignments that were posted on the class website on Blackboard.com. The professor also used Internet to give example of web sites for students' projects. In addition to lecture, Professor C was constantly helping students in doing group projects in addition to individual exercises and homework. The exercise of the day was applying leadership skill in an e-meeting. Students were divided into

four groups and each group must use AOL instant messaging for their e-meeting. They were not allowed to talk to each other.

In an interview, the professor gave an argument:

> "*I do lecture, very short lectures. My lectures are not longer than 15 to 20 minutes. And so I do very short lectures. They tend to be...(pause) that's why project-based seems to be the best...(pause) not the best...(pause) wait...(pause) it's the way I find my students like to learn. And they learn more from me through those project-based than I can give to them lecture-way wise. I make sure my projects get them involved with the materials that I want them to learn*" (Personal communication, September 11, 2003).

Professor C demonstrated that argument in three classroom observations, where students were working on a project in the first observation, creating models in the second observation, and conducting e-meeting in the third.

In addition, professor C's syllabus described the group project assignments as "groups of 4 students each will form research and discussion teams combined with a group of four students from another class. Teams will be assigned a research project each to complete and present the results to the class on a rotating basis during the second half of the semester. Students will be graded on their efforts at collaboration with their team -- in particular using Blackboard.com as a platform for communication -- as well as their research project and presentation." The collaboration was graded through observing how the group works in classroom exercises and the quality of the group work, such as meet the deadlines and fulfill the requirements. Indeed, three observed class meetings confirmed that professor C practiced "*Students work on projects*"

teaching method. The professor required students to work on group projects in all three observed class meetings. On average, Prof. C employed "*Lecture*" method for 34% only, but practiced "*Students work on projects*" method for 66% of class time. These observations confirmed Prof. C practiced "*Students work on projects*" as the professor stated in the survey.

Professor D's teaching method

In the survey, professor D chose age group between 41-50 years old and had been teaching for 11-15 years. The professor had been using computer for three years and chose teaching method "*Other/All of them.*" The professor started using mobile computer three years ago. Professor D implemented "*Other/All of them*" -- combination of lecture, discussion, students lead the class, and students work on projects -- because the professor thought that students could understand certain course materials better if the professor adjusted the teaching method according to topic and section of the course.

Professor D's response in the survey was compared with three classroom observations. The length of first observed class meeting was 52 minutes, the second one 90 minutes, and the third one 100 minutes. In the first observation, professor D lectured for 35 minutes or 67% of the class time and utilized the remainder of the meeting time for other activities, such as consulting or assistance, questions and answers, handout distribution, and individual help. Thirty-six students attended the class, and all of them brought wireless laptop computers. The professor used Internet browser to show some images and texts

on the Internet and also for showing the class website on Blackboard.com. The students followed the professor's instruction to visit those web sites with their laptops. On that day, students did an exercise. The exercise was available on the class web site. The professor provided the exercise on paper as well for students who did not want to work on their laptops. Seven students or 19.44% of all students did their exercise on paper.

Professor D lectured in the second observed classroom meeting for 80 minutes or 89% of class time and 10 minutes for discussion. Twenty-five students attended the class and all of them brought laptops. The topics of the day were discussing a continent and working in group projects. For the group project, each student signed up for certain topic and then Professor D will put students in groups based on their chosen topic. The group project was due by the end of the semester and each group must present their topic to the class as well.

Professor D lectured in the third observed classroom meeting for 85 minutes or 85% of class time and 15 minutes for discussion. The professor used positive slide projector to show the list of topics for the day in one screen, and images on another screen. Thirty students attended the class, and all of them brought laptops. Southeast Asia was the topic of the day. The professor explained about the region and each country in the region, including its political situation, membership to the United Nations, and natural resources.

Table 29. Professor D's teaching method during three observed class meetings

Prof. D	Method (% of class time)	
Classroom observation	Lecture	Discussion
1	**67**	**33**
2	**89**	**11**
3	**85**	**15**

In the three classroom observations, Professor D lectured on average 80% of class time (Table 29). In an interview, the professor explained:

> *"I would like them to get involved in discussion. I think because we learn from each other, even the professor can learn from the students, and the students learn from each other. So, the discussion is really very important for the education process. Group [project] is also important in my courses because I ask them to work together in group. I give them a list of research topics, each group gets one topic, I divide the class into groups, and then they work together as a group. I think this is very important for the students to learn to work as a team, as a group. And they use different types of research, Internet research, they go on-line, they go to the library, they have to read articles, books, get the information and share the information with each other. They try to organize it together, and also [give] presentation"* (Personal communication, September 29, 2003).

The classroom observation showed that students did not work in groups in classroom. The professor also did not conduct a discussion with specific topic. Instead, the discussion sessions were conducted within the lecture, usually after each topic, or when a student or two asked questions. Students used their laptops for searching information about regions or countries. The observations implied that Prof. D did not employ teaching methods other than "*Lecture*" method as the professor stated in the survey.

Professor D's syllabus described that the course employed a lecture/discussion format. All students were expected to keep up with the readings so as to be able to actively participate in class discussions. Lectures followed the textbooks, but included additional information, explanations, and examples from other sources, such as web sites and course handouts. The observation did not find the students used their laptops by their own choice to support their learning, such as looking for new facts about the topic discussed in the class, because they were instructed to pay attention to the professor's lecture. However, in the first observed classroom meeting, three students used their laptops for instant messaging using MSN, Yahoo, and AOL; two students browsing the Internet for sport news – Boston Red Sox was on Division series competition against Oakland A's in the play-off of that season; and one student kept her favorite screensaver on during the whole class session during the first observed classroom meeting. In the second observed classroom meeting, three students used their laptops for instant messaging with MSN, Yahoo, and AOL; two students played Solitaire game; and one student worked heavily on wordprocessing, typing and editing. In the third observed classroom meeting, one student used her laptop for instant messaging; one student worked on wordprocessing; one student listened to MP3 music; one student worked on Power Point; and one student fell asleep. In sum, three observed class meetings did not show professor D's "*Other/All of them*" teaching method. The professor practiced "*Lecture*" more than other teaching methods.

Professor E's teaching method

In the survey, professor E chose age group between 51-60 years old and had been teaching for more than 21 years. The professor had been using computer for 15 years and chose "*Discussion*" teaching method. The professor started using mobile computer five years ago. Professor E implemented discussion because the professor believed this teaching method could encourage students to participate actively in the class and that through active participation, the students would understand the topic more clearly.

Professor E's response in the survey was compared with three classroom observations that were conducted during the fall 2003 semester. The length of first observed class meeting was 140 minutes, the second one 112 minutes, and the third one 140 minutes.

In the first observation, professor E lectured for 115 minutes or 82.1% of the class time and utilized the remainder for other activities, such as discussion, a break, handout distribution, and individual help. Fifteen students attended the class. None of them brought laptops. The professor used Power Point presentation and inserted four short discussion sessions between topics.

Professor E lectured in the second observed class meeting for 67 minutes or 60% of class time, consultation for 30 minutes or 26.8% to help students arranging a leadership panel with speakers from outside of the campus that would be conducted in the middle of the semester, and used the remainder for discussion and a break. Fourteen students attended the class, and none of them

brought laptops. The professor used Power Point presentation and inserted two short discussion sessions between topics

Professor E lectured in the third observed class meeting for 64 minutes or 45% of class time, discussion for 37 minutes or 26%, helping students working on Excel spreadsheet for 23 minutes or 16.2%, and utilized the remainder for handout distribution and a break. Fourteen students attended the class. All of them used wireless laptop computers they borrowed from the state college. Students worked on exercises on cashflow and financial planning. They submitted their work by the end of the class and used wireless network to send their documents to the printer available in the classroom.

The three classroom observations showed that professor E used lecture method for on average 62.4% of class time (Table 30). The lectures were conducted using Power Point slides with some multimedia capability, such as movie and sound, that was embedded some slides. The finding from observed classroom showed that Professor E did not give students Power Point handout. In an interview, the professor clarified:

> "We have to make sure we get to that material. That's right. The reason I don't like it [lecture] there [because I don't want] the students spend all the time copying everything down from the Power Point instead of paying attention to the discussion. I don't like that [copying Power Point slides]. I don't like them seeing ...(pause) writing...(pause) [although] they will do that tonight. They will have to write down everything from every screen. And we go through about 40 screens in the class. I mean, that's a lot for them to write down everything. If we have a discussion, and I have an outline there, especially a course that is really mine, then I make sure in the discussion that they get it and they are not taking notes" (Personal communication, September 25, 2003).

However, the professor did post the Power Point document to the course web site and expected students to download it.

Table 30. Professor E's teaching method during three observed class meetings.

Prof. E	Method (% of class time)	
Classroom observation	Lecture	Discussion
1	**82.1**	**17.9**
2	**60**	**40**
3	**45**	**55**

Professor E's syllabus described that the course used the following teaching methods: computer assisted lecture and discussion, videotapes, practice learning environment projects, oral presentations, examination, and computer lab. The observed class meeting showed that the professor lectured, conducted discussion, and worked on case studies. However, three observed class meetings did not show professor E's "*Discussion*" teaching method.

Table 31 shows five professors' teaching method in the survey and after classroom observations and interviews.

Table 31. Five professors' teaching methods in the survey and after classroom observations and interviews

Professor	**Teaching Method**	
	Survey	**Observation and Interview**
A and C	*Students work on projects*	*Students work on projects*
B	*Students work on projects*	*Lecture*
D	*Other/All of them*	*Lecture*
E	*Discussion*	*Lecture*

Participants' Teaching Styles

The five professors in the case study chose five different teaching styles in the survey questionnaire number 10 (Appendix 2). Professor A selected "*Formal Authority*." Professor B selected "*Delegator*." Professor C selected "*Expert*." Professor D selected "*Facilitator*." Professor E selected "*Personal Model*." Table 32 shows five professors chose five different teaching styles.

Table 32. Five professors chose five different teaching styles in the survey

Professor	Teaching Style
A	*Formal Authority*
B	*Delegator*
C	*Expert*
D	*Facilitator*
E	*Personal Model*

The case study compared five participants' responses in the survey in phase one with classroom observations and interviews with the participants. Participants' teaching styles in the classroom settings were in fact dominated by "*Formal Authority*," "*Delegator*," "*Expert*," and "*Personal Model*" styles. "*Facilitator*" teaching styles did not emerge as strong, even in a participant who selected the teaching style in the survey in phase one of this study.

Professor A's Teaching Style

Professor A selected "*Formal Authority*" teaching style represented by a statement in the survey that said "*I provide feedback, establish learning goals*

and rules of conduct for students. I describe the acceptable ways to do things and provide students with the structure they need to learn."

Three observed class meetings showed that setting the rules for students to learn was necessary for Prof. A. The professor read the rule of conduct in the class, clarified what were acceptable and unacceptable behaviors, and reiterated the rules whenever the professor had a chance during the lecture as reported in the previous section on teaching method. In this class, professor A perceived consulting as "providing feedback" as was stated in the "*Formal Authority*" teaching style that the professor chose in the survey. The professor's teaching style was confirmed when, in the second observation, the professor practiced "*Formal Authority*" using 44 minutes or 92% of class time for lecturing and four minutes for helping students. However, "*Facilitator*" teaching style that was the professor's second choice in the survey, emerged in the third observation when the professor was helping students or consulting for 113 minutes or 94% of class time with the remaining 6% for lecturing.

In an interview, professor A said that setting up rules was important for students so they have direction in learning the subject matter. Furthermore, the professor explained:

> "*I have to give them appropriate information, to give them some frameworks to [work with] like I did the framework in yesterday's class. So I have to give them something to work with and then they have an idea what [questions] I was going to ask the next day*" (Personal communication, December 8, 2003).

Three observed class meetings confirmed professor A's "*Formal Authority*" teaching style.

Professor B's Teaching Style

Professor B chose "*Delegator*" teaching style that that was represented by a statement in the survey that said "*I encourage students to become self-directed, self-initiating learners. The students work independently on projects or part of teams. I am available as a consultant and resource person.*"

Three classroom observations showed that professor B indeed practiced the "*Delegator*" teaching style. In the first observation, professor B lectured for 86 minutes or 91% of the class time and the rest for other activities, such as questions and answers, handouts distribution, and individual help. In this class, professor B who chose "*Delegator*" teaching style in the survey used lecture as part of preparing students to understand the course materials before working on their projects independently. The professor was available as a consultant and resource person. Professor B's teaching style was confirmed when, in the second observation, the professor seemed to be practicing "*Delegator*" when the professor was conducting lecture for 50 minutes or 47% of class time, but gave the students time to present some of their projects to the class and had question and answer session for 57 minutes or 53% of the class time. The students could ask the professor for an opportunity to present their project to the class as a trial. The students showed their work as a draft and could ask the professor or students for constructive criticism. Professor B's "*Delegator*" teaching style

emerged again in the third observation when the professor asked students to present their projects for almost 27 minutes or 26% of class time. This time, the professor set up the schedule for the students to present their projects.

In an interview, professor B said:

> *"I think students learn better if they're self-directed. If they have a reason to look up something, they are gonna enjoy what it is they are learning. Maybe I am putting too much on my own type of learning style in there, but I know that I had other graduates and students I that had in my class who said that they like that type of learning style, the way they demonstrate how to do it, they actually go and do it, do the research, and come back with tangible object"* (Personal communication, December 2, 2003).

Indeed, three observed class meetings confirmed professor B's "*Delegator*" teaching style.

Professor C's Teaching Style

Professor C selected "*Expert*" teaching style that was represented by a statement in the survey that said "*I strive to maintain status as an expert among students by displaying detailed knowledge and by challenging students to enhance their competence. I like students who are well prepared.*"

Three observed class meetings showed that professor C had demonstrated the mastery in both the subject and course materials. The major activity in the first observation was consulting or assistance for 52 minutes or 48% of class time. The major activity in second observation was students work on group projects for 36 minutes or 32% of class time. The major activity in third observation was lecture for 48 minutes or 48% of class time. In those classes, it was demonstrated that professor C's experience and expert knowledge was

important to help students understand the course content. The professor lectured on a concept, and then showed an example from the field, and then described the problems that were not cited in textbooks. In three observed class meetings, professor C demonstrated mastery knowledge in management organization and did not hesitate to challenge students to engage in difficult tasks, such as on-line research for a group presentation at the end of the class as the professor did in the first observed class meeting and with the application of leadership model into a real organization in the second observed class meeting. In the third observed class meting, professor C divided the class into five groups. Each group then conducted an e-meeting through a virtual discussion room on the Internet. The students could not talk directly to each other. Instead, they must communicate through the virtual discussion room. Professor C's instructions were that there should be no talking, the students should use the chat room, and only the professor can talk.

In an interview, professor C demonstrated mastery of the course materials and the subject by saying that the course would not depend on textbooks. Prof. C also selected web sites to inform the students about new developments in the field. Prof. C was always paying attention to new findings in the field and was not afraid to introduce new evidence to the students. Professor C said that new materials would be added to the course during the semester because the professor was involved in an on-going collaboration project among the state colleges in the region (Personal communication, September 11, 2003).

Professor C was also active in a professional association in the field and attended at least two conferences on the subject every year. Indeed, three observed class meetings confirmed that professor C practiced "*Expert*" teaching style.

Professor D's Teaching Style

Professor D chose "*Facilitator*" teaching style that was represented by a statement in the survey that said "*I emphasize the personal nature of teacher-student interactions. I work with students on projects in a consultative fashion and try to provide as much direction and support as possible.*"

Three observed class meetings demonstrated that professor D implemented "*Facilitator*" teaching style. In the first observation, professor D lectured for 35 minutes or 67% of the class time and used the remainder of the times for other activities, such as consulting or assistance, questions and answers, handout distribution, and individual help. In this class, the professor who chose "*Facilitator*" teaching style perceived lecturing as part of giving directions and providing help to students. For example, the professor explained how to use Power Point application, how to download a file from the class web site, and how to use an application for the class project. Professor D also encouraged students to meet, to send an e-mail, or to make a phone call to the professor if they have problems. The professor was also ready to help students who had problems in doing the exercises, quizzes, or group projects. Nevertheless, professor D's teaching method was dominated by lecturing in the

second and third observations, 80 minutes or 89% of class time and 85 minutes or 85% of class time respectively that contradicted the professor's selection of the "*Facilitator*" teaching style.

In an interview, Prof. D explained:

> "Actually when I first started, I used to do more lectures than group projects or discussions. But, later on I realized that lecturing is not always good for the students because I don't want students to come and sit down and just listen. I talk and they listen. No, this is not a good idea. Even for them. They have to depart from this process. They have to receive and give. Yeah. So, participation in discussion, I think, this is something I started to do later and also the group project mainly when I first came, we didn't have wireless technology. We didn't have laptop computers. They still do group research. But with the computer, with the laptop, this makes it easier" (Personal communication, September 29, 2003).

Professor D asked students to participate actively during the lectures, such as asking students intriguing questions, although only three or four students participated in the discussion, quite a small number for a class with 22 students. However, three observed class meetings did not show professor A's "*Facilitator*" teaching style. Instead, observations showed that the professor practiced more of an "*Expert*" style more than other teaching styles.

Professor E's Teaching Style

Professor E selected "*Personal Model*" teaching style that was represented by a statement in the survey that said "*I believe in "teaching by personal example." I oversee, guide, and direct by showing how to do things and encourage students to observe and then to emulate my approach.*"

The three observed class meetings demonstrated that professor E always used personal experience to explain the course materials. In the first observation, professor E lectured for 115 minutes or 82% of the class time and the rest for other activities, such as discussion, a break, handouts distribution, and individual help. In this class, the professor who chose "*Personal Model*" employed personal experience as part of the lecture. For example, professor E asked, *"What is your superior's comment when you tell him or her that you take graduate courses?"* Professor E then shared some of the professor's experience and told the students to take a lesson from the story. However, professor E's teaching method was dominated by lecturing in the second and third observations, 67 minutes or 60% of class time and 64 minutes or 45% of class time respectively. Nevertheless, the professor was always ready to help students and in doing so, Professor E tried to empathize with the students. *"I want to make sure everybody understands. I am here to help*," the professor told students in the third observation. Indeed, the professor conducted consulting and provided assistance for students for 30 minutes (27% of class time) in the second observation and 23 minutes (16%) in the third observation. Indeed, three observed class meetings confirmed that professor E practiced "*Personal Model*" teaching style. Table 33 shows the five professors' teaching styles in the survey and after classroom observations and interviews.

Table 33. Five professors' teaching styles in the survey and after observations and interviews

Professor	Teaching Style	
	Survey	Observation and Interview
A	*Formal Authority*	*Formal Authority*
B	*Delegator*	*Delegator*
C	*Expert*	*Expert*
D	*Facilitator*	*Expert*
E	*Personal Model*	*Personal Model*

Participants' stage of technology adoption

Five participants chose four different statements that represented levels of technology adoption stage among teachers based on Apple Classroom of Tomorrow or ACOT (Dwyer, Ringstaff, & Sandholtz, 1990) study in the survey questionnaire number 8 (Appendix 2).

This section presents the result of case study with ACOT stages as the guidance. ACOT stages started from the lower to the higher stage: *Entry, Adoption, Adaptation, Appropriation*, and *Invention*.

Professors A and D chose the statement that represented "*Adaptation*" stage. Professor A instructed students to submit their reports and assignments promptly, to communicate with each other and the professor with e-mails, and to do group works virtually via course web site and instant messages. Three advantages that Professor A mentioned were punctuality, output quality, communication, and convenience. Although professor A never used computer in the classroom, the professor asked students to send their assignments through

e-mails and the class virtual drop box, invited students to on-line discussions, and posted announcement on the course web site. The observed class meetings and interviews demonstrated that Professor A was in the right stage of "*Adaptation*" stage.

Professor D also selected "*Adaptation*" stage, reporting a desire to see two aspects before using new technology: First, how the technology would add value to existing practice; second, how much time the professor could save by using the technology. In addition to face-to-face courses, Professor D also taught some on-line courses and occasionally used chatroom and on-line discussion facility for both face-to-face and on-line courses. The observed class meetings and interviews demonstrated that Professor D was in the right stage of "*Adaptation*" stage.

Professor B chose the self-assessment statement that indicated "*Appropriation"* stage, the highest stage among the participants. In describing the advantage of mobile computing in making teaching easy, and in helping the professor in adapting to students' learning styles, professor B reported that the professor's former students applauded the multimedia function and Power Point presentation that the professor used in the classroom. The students reported that those presentations made them ready to create effective presentations in their workplace after they graduated. Professor B also mentioned convenience, adaptability to student needs, and enrichment of the students experience, as

benefit of using technology. The observed class meetings and interviews demonstrated that Professor B was in the stage of "*Appropriation,*" as selected.

Professor C selected the statement that represented *Entry* stage, the lowest technology adoption stage. Reflecting from the e-meeting activity in the classroom, Professor C said that students could learn to conduct meetings both via face-to-face and via technology. This activity, the professor said, was a golden opportunity to teach students about the differences between both media, when and how to accomplish the same task using both jointly. The professor hoped that students would never take face-to-face communication for granted. The professor also used Personal Data Assistant (PDA) with infrared and presentation ports, "in case the laptop and desktop in the classroom don't work" (Personal communication, September 11, 2003). Professor C had been involved in a state college collaboration project in implementing on-line discussion system among state colleges in the area since the 1990's. The observed class meetings and interviews demonstrated that Professor C was very competent in the use of technology, which contradicted extremely with the self-assessed choice in the survey of being at the "*Entry*" stage. Professor C should be in "*Invention*" stage.

Professor E selected the statement representing the "*Adoption*" stage. The professor said that the laptop was just another tool. Professor E did not use technology in other courses that required human touch in clinical works, commenting that "*...if they [computers] all die tomorrow, we still do what we do*" (Personal communication, September 25, 2003). However, the professor saw

that technology could motivate students because they were interested in new things. Professor E always prepared back-up materials with transparency and paper-based presentation in case the professor has problem with Power Point slides. The observed class meetings and interviews demonstrated that Professor E was in the right stage of technology adoption: "*Adoption*" stage. Table 34 shows five professors' technology adoption stages. None of the participants chose the statement that described the "*Entry*" stage.

Table 34. Five professors' observed technology adoption stages

Professor	Technology Adoption Stage
None	*Entry*
E	*Adoption*
A and D	*Adaptation*
B	*Appropriation*
C	*Invention*

Participants' use of mobile computing technology inside and outside of their classrooms

The case study compared five participants' responses in the survey in phase one with classroom observations and interviews with the participants. Participants' use of mobile computing technology in their classrooms was measured from the percentage of class time with the technology, in particular time spent both by professors and students in utilizing wireless laptop computers. During this research, Professor B, D, and E used wireless laptop computers in the classroom, while professor C used desktop PC in the teacher's desk, and

professor A never used computer in the classroom. However, students used wireless laptop computers in all classrooms.

Five participants chose two different percentages of mobile computer in the classroom in the survey questionnaire number 9 (Appendix 2). The survey results informed that Professor A, B, and C chose "26%-50% of class time" for mobile computer use in the classroom. Meanwhile, Professor D and E chose "6%-25% of class time." Table 35 shows five professors' mobile computer use in the classroom based on percentage of their class time.

Table 35. Five professors' mobile computer use in the classroom (% of class time) in the survey and observation

Professor	Mobile computer use in the classroom	
	Selected	Observed
A	**26%-50%**	**26%-50%**
B	**26%-50%**	**51%-75%**
C	**26%-50%**	**51%-75%**
D	**6%-25%**	**51%-75%**
E	**6%-25%**	**6%-25%**

The observed class meetings, however, indicated that Professors B, C, and D spent more time in using mobile computer in their classrooms than they had selected: more than 50% of class time, but not more than 75% of class time.

Professor B commented about the discrepancy by saying that the percentage was applied to both students and faculty because the professor used the technology more than the students. Professor C explained that the percentage was based on students use, but if there wasn't a teacher station with a desktop computer and an LCD projector, the professor would be using

personal laptop and borrowed a portable LCD projector for the department. Meanwhile, Professor D who showed a big difference in the survey response (6%-25%) and classroom observation (50% or more) explained that when the professor chose 6%-25%, it meant for the whole semester with 15 weeks of class sessions. "*We don't use computer every session, it varies from one session to another*" (Personal communication, February 13, 2004). The observations confirmed that Professor A and E spent class time as they stated in the survey, "26%-50%" and "6%-25%" of their class time respectively.

Off-line mobile computing activities outside of the classroom

In terms of off-line mobile computing activities outside of their classrooms, Professor D and E who spent "*6%-25% of class time*" for mobile computing in the survey claimed that they spent on average about 10 hours per week. Meanwhile, Professor A, B, and C who spent "*26%-50% of class time*" claimed in the survey that they spent on average about 26 hours per week for off-line computer activities. Table 36 describes the five professors' off-line computer activities and the duration of those activities outside of the classroom per week.

Table 36. Average time spent for off-line mobile computing activities by five professors outside of the classroom (hours per week)

	Professor A and E (selected "*6%-25% of class time for mobile computing*" in the survey)	Professor B, C, and D (selected "*26%-50% of class time for mobile computing*" in the survey)
	The professors above used the following off-line activities when outside of the classroom (hours per week)	
Preparing leson plan	1	3.67
Preparing handouts	0.75	2.33
Administrative tasks	1.5	1.3
Preparing Quiz	1.5	1.6
Grading assignments	2	10
Writing research report	0.5	1
Preparing presentation	2	5
Learning new software	1	1.33
Playing games	0	0.08
Total time (hours)	**10.25**	**26.31**

On-line mobile computing activities outside of the classroom

In terms of on-line mobile computing activities outside of their classrooms, Professor D and E who spent "*6%-25% of class time*" for mobile computing in the survey claimed that they spent on average about 13 hours per week. Meanwhile, Professor A, B, and C who spent "*26%-50% of class time*" claimed in the survey that they spent on average about 18 hours per week for off-line computer activities. Table 37 describes the five professors' on-line computer activities and the duration of those activities outside of the classroom per week.

Table 37. Average time spent for on-line mobile computing activities by five professors outside of the classroom (hours per week)

	Professor A and E (selected "*6%-25% of class time for mobile computing*" in the survey)	Professor B, C, and D (selected "*26%-50% of class time for mobile computing*" in the survey)
	The professors above used the following on-line activities when outside of the classroom (hours per week)	
E-mail	4	7
Internet Research	2	4.33
Reading news	1.25	2.5
Chatroom/on-line discussion	4	2.33
Getting pictures/images	0.5	0.5
Getting sound files	0.3	0
Getting video files	0.3	0
Editing personal/professional web sites	0	0.92
Using databases	1	0.67
Playing games	0	0.08
Total time (hours)	**13.35**	**18.33**

Five professors' expression on advantages of mobile computing

Participants of the case study were respondents in the survey in the first phase of the study. Their responses on advantages of mobile computing were compared with the classroom observations and interviews in the case study in the second phase. In terms of advantages of mobile computing, these five professors rated their agreement from 1 to 4 where 1 was "strongly disagree" and 4 was "strongly agree" on 11 statements in question number 13 (Appendix 2) that described the advantages of mobile computing. The survey results showed that four professors, except professor B, rated 3 or 4 on all advantages.

Only one of them, Professor B, disagreed with advantage "*constant accessibility*" and "*collaboration in common experience.*" Professor B reported that the laptop had a limited space for storing Power point and graphic files. The

professor preferred using desktop computers and college database for that purpose. So, there was no constant accessibility to the database if the laptop was overloaded. The desktop and campus database were also not accessible from laptop. In terms of collaboration, professor B did not use on-line facility for group works because the students were busy with work and study, and had difficulty to arrange time for virtual meeting synchronously. Nevertheless, students in professor B's class could finish their group and individual projects through asynchronous media, such as e-mail, group folders in the course web site, and bulletin board. Their wireless laptop computers also enabled them to do research, to compose a report, and to prepare a Power Point presentation.

Professor A added that faculty and students can share experiences in using the technology. "Faculty can learn from students' use of the technology – [therefore] learning is easier." Despite this claim, the classroom observations and interviews did not find the professor A learned from the students. It might be in the past when the professor was just starting using wireless laptop computer that professor A learned from the students.

Professor A added the convenience of having virtual place for documents and course materials in course site on the Internet. In an interview, Professor A said:

> *"I couldn't do that before. I can ask them [students], let say if we are opening a small business. So I provided them with different resources for start up cost. I did provide them with additional web sites, so they can go and look at. I couldn't do that before. I can still do it with pen and pencil. I could have printed it out [and consumed] a whole bunch of trees. But I didn't do that. I gave*

them, put it on the web site, go to some of the web sites, so you don't have to use paper. Or, 'I've lost my syllabus', or 'I lost my documents'. It's always there (Blackboard.com). So they can go and do that. I now provide them with my notes. So I have my notes, so they have my notes, so they know exactly what I am talking about" (Personal Communication, September 18, 2003).

Professor E added a comment that mobile computing was available to students' situations with disability needs. The professor taught courses that related to healthcare management. However, the classroom observations did not find any students in the professor's class who were disabled. In one classroom observation, students used laptop computers and worked on an classroom exercise. In an interview, professor E reported that using wireless system help the professor and the students to finish class exercises.

> *"I think without the wireless we would just make the [class] assignment and not really got [through] with the process [of finishing the exercise]. It was chaotic but it's not [unorganized]. I have to tell you that we were having really good times. It was OK. Not one [student] got out of control. I like it. It [exercise lab] was a good class. But it [the use of wireless laptop computer in the classroom] allows us to use computers as critical thinking tool*" (Personal Communication, November 30, 2003).

Professor B cited organization and storage as the advantages of mobile computing:

> "*It [laptop computer] keeps me on task. I tend to teach and bring a lot of different examples and ideas from experience. And I sometimes get off track, but having the computer and knowing that this is what I am gonna have to start with and this is what I am gonna do next, which I did anyway. Before I have Power Point presentation, I used to have [transparencies], [now] this [laptop computer] is my organization, my file cabinet*" (Personal communication, September 30, 2003).

Professor B had an extensive collection of digital and non-digital images that occupied a great deal of storage space in desktop computer, laptop computer, bookshelves, and filing cabinets. Professor B's wireless laptop computer, especially with Power Point and Windows Explorer applications, could help the professor organizing the lectures, assignments, projects, quizzes, and students' internships.

Professor D expressed a satisfaction on the use of mobile computing on campus. The professor stated that mobile computing was good if all professors can maximize its advantages, use it for getting access to all information and for communication with students. Professor D reported that mobile computing technology helped a lot in teaching, especially on-line teaching. Students could learn conveniently according their schedule and place. Professor D liked the wireless laptop computer because it gave two advantages: accessibility and increase the ease of communication between students and professor or among students themselves. The technology saved time and locations, such as the professor could work from home, especially those that were served by high-speed Internet connections.

All five professors in case study cited several advantages of mobile computing that were not in the survey, such as virtual storage space, help disable students, and facilitate on-line learning. Their statements added the evidence of advantages of mobile computing in higher education setting.

Five professors' expression on disadvantages of mobile computing

Participants of the case study were respondents in the survey in the first phase of the study. Their responses on disadvantages of mobile computing were compared with the classroom observations and interviews in the case study in the second phase. In terms of disadvantages of mobile computing, five participants rated their agreement from 1 to 4 where 1 was "strongly disagree" and 4 was "strongly agree" on nine disadvantages stated in question number 15 of the survey (Appendix 2).

All five professors in the case study disagreed with the disadvantage "*feeling lonely and isolated*," "*mobile computing is unreliable/easily break*," and "*low quality wireless connection*." In addition, professors A, C, and D agreed on disadvantage "*lack of time for personal activities*." Professors A, B, and D agreed on disadvantage "*too many e-mails to read*." Professors A and B agreed with disadvantage "*limited battery life*." Professor D agreed on disadvantage "*too expensive*" and Professor B agreed on disadvantage "*too many accessories needed*."

Professor A commented about the disadvantages: "*I would say…the major problem is the connection to the Internet. The laptop I think it is fine, but I cannot control the instant messaging. I can't control that. I can't be on the [Black]board[.com], I cannot be making instructions…having instruction with them [students], [while at the same time] controlling instant messaging on the other end*." Professor A regarded mobile computing as a distraction sometimes.

Professor B reported that there were problems with wireless computing. The professor added: "*One is the advantage of the ability for [all the] students to be on-line at the same time is sometimes [too difficult and] not happening. It's technological thing just as if the light went out in the room, you have deal with it, and have some kind of other activity.*" In this regard, professor B considered mobile computing unreliable, but appeared to be unfazed by this particular problem.

Professor C complained about waiting time if using laptop for on-line activities. The professor added:

> "*Getting on-line when you bring the whole classroom on-line, I have almost 30 students in the class, they can't get on at once. It's like sending 30 people through one narrow doorway. It can't be done. And so they have a lot of problems. It takes time to set up. Once they are all on-line, it's also slower. The more on-line, the slower it is. So speed is the big thing. So speed and getting on-line all at once, access, getting on and off, sometimes, and the wait, sometimes it's definitely the wait. The other thing here some faculty find instant messaging be problematical, I don't find it that problematical, only once in a while. Most of the time my students are too busy to be able to do that. So basically for me it becomes a non-issue, but it can be a disadvantage*" (Personal communication, September 11, 2003).

Professor C showed how slow it was to start up a laptop computer and to open a Power Point file because the professor's files usually have pictures and animation. Nonetheless, during classroom observations, the connection to the Internet looked fine because the professor could open a course web site easily.

Professor D stated:

> *"Sometimes when the server is down. Sometimes we come to the classroom, I don't understand, it happened in the first two weeks here, some students can go on-line, while other students they cannot. In the same classroom, I teach in the same classroom, some students can log into network and go on-line while other students they cannot. If you're planning to use laptop in the class for something and students cannot go on-line, this is a problem"* (Personal communication, December 5, 2003)

The Internet connection was not reliable and slow. There was a virus attack in the first two weeks of fall 2003 semester and the Office of Information Technology had been responding to the problem (Chapter 4, "Worm attack in the first two weeks of fall 2003").

Professor E reported upfront workload as a disadvantage, such as preparing presentation and scanning graphics. The professor added:

> *"[Therefore] it is very hard to convince someone who has been teaching for 15 years and I want them to stop and put the course on Blackboard. Even to use Power Point, I mean they have the same transparencies they have been using forever and why should I have to prepare something new. So I think it would get better as we get new faculty members but it's hard for the old, I don't mean the age wise but I mean someone who has been around for very long time, to change"* (Personal communication, November 30, 2003).

All five professors in case study cited several disadvantages of mobile computing that were not in the survey, such as Internet connection problem, slow speed, and extra workload. Their statements added the evidence of disadvantages of mobile computing in higher education setting.

Participants' pattern of computer use: weekdays and weekends

Mobile computing makes it possible for professors and other professionals to work 24 hours and seven days a week; what has become commonly known as "*24/7*." Their activities included reading and responding to e-mails from students and colleagues, and at the same time keeping up with new developments in their discipline by joining professional and academic associations.

In the survey, professors indicated constant work using computers, either laptop or desktop. Almost all of five professors who participated in the case study stated in the survey that they were working on computer almost all the time when they were on campus in the morning and afternoon. Only professor D did not work on computer on campus in the afternoon. The computer activities they did on campus were usually Wordprocessing, Power Point, E-mail, and Internet research. Only professor C opened a chatroom for on-line discussion. At home in the evening during weekdays, those professors were usually working on Wordprocessing, Power Point, E-mail, and Internet research. Professor D and E added their computer activities with opening a chatroom for on-line discussion with colleagues or students (Table 38).

All of them also worked on computer at home in the evening at least some of the time between 6:00 PM and midnight. Professor C even worked the whole night until early morning. The data indicated that the five professors who participated in the case study were working on computer on campus and at home during weekdays. One of them, professor C, even sometimes worked until pass

midnight to early morning. The five professors were working on their computer during the weekdays on campus and at home.

Table 38. Five professors' computer activities during weekdays

Professor	Weekdays			
	6:00AM-12:00PM	12:01PM-6:00PM	6:01PM-12:00AM	12:01AM-5:59AM
A	Power Point, E-mail, Internet browsing	Power Point, E-mail, Internet browsing	Wordprocessing, E-mail, Internet browsing	**0**
B	Wordprocessing, Power Point, E-mail, Internet browsing	Wordprocessing, Power Point, E-mail, Internet browsing	Wordprocessing, Power Point, E-mail, Internet browsing	**0**
C	Power Point, chatroom/on-line discussion	Wordprocessing, Power Point, chatroom/on-line discussion	Wordprocessing, E-mail, Internet browsing	Wordprocessing, E-mail, Internet browsing
D	Wordprocessing, Power Point, E-mail, Internet browsing	**0**	E-mail, Internet browsing, chatroom/on-line discussion	**0**
E	Wordprocessing, Power Point, E-mail, Internet browsing	Wordprocessing, Power Point, E-mail, Internet browsing	E-mail, Chatroom/on-line discussion	**0**

During the weekends, five professors worked at home. None of them worked on campus. Four professors worked on computer in the morning, while professor C did not. In the afternoon, four professors worked on computer, while professor D did not. The computer activities they did in the morning and afternoon usually Wordprocessing, Power Point, E-mail, and Internet research (Table 39). In the evening, four professors worked on computer, while professor B did not. In midnight and early morning, only Professor A and professor C worked on computer while the other three professors did not. Professor A even

sometimes worked until pass midnight and early morning. In the evening, professor D and E usually opened a chatroom for on-line discussion with students or colleagues.

Table 39. Five professors' computer activities during weekends

Professor	Weekdays			
	6:00AM-12:00PM	12:01PM-6:00PM	6:01PM-12:00AM	12:01AM-5:59AM
A	Power Point, E-mail, Internet browsing	Power Point, E-mail, Internet browsing	Wordprocesing, E-mail, Internet browsing	**0**
B	Wordprocessing, Power Point, E-mail, Internet browsing	Wordprocessing, Power Point, E-mail, Internet browsing	Wordprocessing, Power Point, E-mail, Internet browsing	**0**
C	Power Point, chatroom/on-line discussion	Wordprocessing, Power Point, chatroom/on-line discussion	Wordprocessing, E-mail, Internet browsing	Wordprocessing, E-mail, Internet browsing
D	Wordprocessing, Power Point, E-mail, Internet browsing	**0**	E-mail, Internet browsing, chatroom/on-line discussion	**0**

Participants' expressions that demonstrated the values of post-modernism professionalism

Mobile computers such as wireless laptop helped teachers acquire post-modernism professionalism that is measured by teachers' ability to work in any place at any time, further blurring the distinction between home and school, work and leisure, thus changing the teaching profession (Fisher, 1999). Table 40 shows the professors' work habits during weekdays and weekends related to post-modernism professionalism. The five participating professors reported working 75% of the time slots during weekdays and 55% of the time slots during weekends.

Table 40. Five professors' work habits during weekdays and weekends

Professor	Weekdays				Weekends			
	6:00AM-12:00PM	12:01PM-6:00PM	6:01PM-12:00AM	12:01AM-5:59AM	6:00AM-12:00PM	12:01PM-6:00PM	6:01PM-12:00AM	12:01AM-5:59AM
A	Working	Working	Working	Not Working	Working	Not Working	Not Working	Not Working
B	Working	Working	Working	Not working	Working	Working	Not working	Not working
C	Working	Working	Working	Working	Not working	Working	Working	Working
D	Working	Not working	Working	Not working	Working	Not working	Working	Not working
E	Working	Working	Working	Not working	Working	Working	Working	Not working

Based on Thematic Analysis (Boyatzis, 1988), the transcriptions of interviews and classroom observations were analyzed and matched with seven

principles of "Post-modernism professionalism" that was initiated by Hargreaves and Goodson (1996).

Five professors' comments and opinions were matched with each principle. For example, Professor B reported that every student in the professor's course could make suggestions on how the class project be done. If the student has a problem, the professor was willing to listen and to help the student solve the problem so the project can be done according to the professor's standards. "If they give me a project that came back, I would say 'this is what you need to make, to do better to get a better grade. You have another week to rewrite this'" (Personal communication, December 2, 2003). The professor's statement indicates the practice of Principle 1 of "Post-modernism professionalism": "*increased opportunity and responsibility to exercise discretionary judgment over the issues of teaching, curriculum and care that affect one's students.*" Appendix 14 shows the statements of five professors who participated in case study in phase two. In summary, all five professors' reports corresponded to the seven principles of "Post-modernism professionalism." However, it was remained to see if those professors were actually practicing the principles when they were not interviewed and observed. Chapter 5 will discuss these findings further.

Distraction as a disadvantage of mobile computing

Distraction was one of the problems cited by several studies on the use of mobile computing in the classrooms (Grace-Martin & Gay, 2001, Educause Center for Applied Research, 2002; Schwartz, 2003). The previous studies did not specify the situation of the class when the students got distracted. Schwartz (2003) found that a professor perceived the distraction as a challenge for him to teach better to make students keep paying attention to his lectures. In this study, however, the professor's perception of distraction varied based on the professor's teaching method, teaching style, and technology adoption stage.

In the survey, three professors or 10% of respondents found that wireless laptop computers have created distraction in the classroom. The survey data showed that the three professors had one similarity: they used "*Formal Authority*" teaching style. Their statements were:

(1) "They are often a distraction in the classroom." The professor used combination of lecture, discussion, and other teaching methods, "*Formal Authority*" teaching style, but did not choose a technology adoption stage.

(2) "Temptation of distraction." The professor used 'students lead the class' teaching method, "*Formal Authority*" teaching style, and "*Adoption*" stage (second level of technology adoption stage).

(3) "Disruption in class when students play games." The professor used 'discussion' teaching method, "*Formal Authority*" teaching style, and "*Adoption-Adaptation*" stages, second and third level of technology adoption stage.

In the case study, five professors had different opinion about distraction. However, their teaching styles were not corresponding with their perception on distraction. Professor A used *Formal Authority*, professor B used *Delegator*, professor C used *Expert*, professor D used *Facilitator*, and professor E used *Personal Model*. The case studies showed that professors A and B acknowledged the possibility that students were multitasking with e-mail, instant message, or other kinds of computer activity outside of the class works. However, they did not think of other activities as a distraction. The only similarity between professor A and B who were more lenient on students' other activities in the classroom was they both used "*Students works on projects*" teaching method. Other professor who used similar teaching method was professor C, but this professor preferred students to pay attention to the lectures, presentations, exercises, assignments, and other suggested classroom activities. Appendix 15 shows each professor's statement regarding this issue.

Summary of Case Studies

Five professors' responses through a survey, two interviews, and three classroom observations provided additional information about the variables of this study. The independent variables are teaching method, teaching style, technology adoption stage, and mobile computer use in the classroom. The dependent variables are professors' perception of advantages and

disadvantages of mobile computing. Table 41 shows the variables after interviews and classroom observations.

Table 41. Five professors' teaching method, style, technology adoption stage, mobile computer use and the advantages of disadvantages of mobile computing

Professor	Independent variables				Dependent variables	
	Teaching method	Teaching style	Technology adoption stage	Mobile computer use (% of class time)	Advantages	Disadvantages*
A	Lecture	Formal Authority	Adaptation	26%-50%	Agreed all	Agreed on *"lack of time for personal activities"; "too many e-mails to read"; "limited battery life."*
B	Students work on Project	Delegator	Appropriation	51%-75%	Agreed all except *"constant accessibility"* and *"collaboration in common experience."*	Agreed on *"too many e-mails to read"; "limited battery life"; "too many accessories needed."*
C	Students work on Project	Expert	Invention	51%-75%	Agreed all	Agreed on *"lack of time for personal activities."*
D	Lecture	Expert	Adaptation	51%-75%	Agreed all	Agreed on *"lack of time for personal activities"; "too many e-mails to read"; "too expensive"*
E	Lecture	Personal Model	Adoption	6%-25%	Agreed all	Disagreed all

*) in addition to disagreement on *"feeling lonely and isolated"*, *"mobile computing is unreliable/easily break"*, and *"low quality wireless connection."*

Summary of Research Findings

Chapter 4 provided findings of the study from survey in the phase one and interviews and classroom observations in phase 2. The findings have shown the demographic data of survey respondents, descriptive statistics of four independent variables: respondents' teaching methods, teaching styles, technology adoption stages, and mobile computer use in the classroom; and two

dependent variables: advantages and disadvantages of mobile computing. Furthermore, the relationship of the four dependent variables and two dependent variables were also presented, along with the result of hypotheses testing.

The results of case studies that were conducted after the survey interview were also presented. Five professors participated in this case studies that employed interviews and classroom observations. The case studies provide a useful parameter to triangulate and in some cases, validate the variables of the study. In addition, the case study also offered an in-depth information that the professors practiced the seven principles of "Post-modernism professionalism" according to Hargreaves and Goodson (1996).

Chapter 5 will discuss the findings as a comprehensive system of variables relationship, compare the findings with relevant previous studies, and answer four research questions as represented in four Null Hypotheses and the main research question: "what do college professors perceive to be the pedagogical advantages and disadvantages of mobile computing in courses that require its use by students?"

CHAPTER 5: DISCUSSION

This chapter presents a review of the study, a discussion of the findings regarding the correlations between each of three independent variables: college professors' teaching methods, teaching styles, technology adoption stages, and the professors' perceptions of the advantages and disadvantages of mobile computing.

In addition, the professors' pattern of computer use outside of the classroom was also surveyed to investigate the possibility that those professors practiced the notion of working 24 hours a day and seven days week known as "*24/7*." Working in this condition could shape the individual's perception of the values of a job that, according to Fisher (1999) and Hargraeves & Goodson (1996), was called "*Post-modernism Professionalism*." The study investigated whether the professors' working schedule and mobile computer use related to their perception of their professionalism. Seven principles of "*Post-modernism Professionalism*" in particular were discussed by employing college professors' perceptions in the case study. Implications and recommendations for further research are also presented.

Review of the study

The purpose of the study was to identify college professors' perceptions on mobile computing, especially as their perceptions related to the pedagogical advantages and disadvantages of mobile computing. The study was conducted during summer and fall semester of 2003 at Suburban State College. The study

was conducted in two phases. In phase 1 data on college professors' demography, teaching methods, teaching styles, technology adoption stages, pattern of computer use inside and oustide classroom, and perceptions of the advantages and disadvantages of mobile computing were collected through survey questionnaires. The survey was mailed to 94 professors on July 14, 2003, and as of November 9, 2003, 30 survey questionaires or 31. 9% had been returned.

Phase 2 was case study in which five professors from the survey in the first phase or 17% of respondents, volunteered to participate by making themselves available for two interviews and three classrooms observations. The case study was conducted from September to December 2003. In this case study, each professor was interviewed twice: in the beginning of the fall 2003 semester and again in the end of the semester. The interviews were audiotaped and transcribed for coding. The professors were also observed three times when they taught their classes: in the beginning, in the middle, and near the end of fall semester 2003. The observations were videotaped and transcribed for coding.

The two phases of the study were arranged sequentially, starting with a survey and then followed by case studies. Therefore, this study employed a combination of quantitative and qualitative methodologies. According to Kelle (2001), this combination yields insights about the investigated social phenomenon. The study observed the participating college professors'

perceptions of the advantages and disadvantages of mobile computing in the courses they taught.

This study took place at a higher education institution that was given the pseudonym Suburban State College. This college is located in the northeastern part of the United States near a major metropolitan area. The subjects of this study were professors at the college who were selected to participate in this study because they taught courses in which laptop computers with wireless Internet connections were required to do some of the work in the course. The college itself has been offering those courses since fall semester of 1998, and in the fall semester of 2002 implemented a college-wide policy requiring incoming first year students to own wireless laptop computers.

The main research question of this study was "*what do college professors perceive to be the pedagogical advantages and disadvantages of mobile computing in courses that require its use by students?*" In addition, the study assessed the professors' post-modernism professionalism or the idea that through mobile computing, one could conceivably work at anytime in the so-called "*24/7*." Computing brings the possibility of continuous access to information and communication that can blur or even eradicate the boundaries separating work from non-work time. This aspect of the study assessed whether mobile computing might strengthen this post-modernism phenomenon because mobile computing greatly increased the professors ability to be on-line anywhere and anytime.

Discussion of the findings

Cuban (1986) and Dockterman (1988) stated that teacher's would use technology if the technology helped them doing their job: teaching. Therefore, Cuban (2001) concluded that teachers have the most vital role in technology use in the classroom. Windschitl and Sahl (2002) suggested that technology implementation should consider the teacher's beliefs about effective use of technology, so they can integrate technology into their traditional practice in the classroom. To acquire an insight of the use of mobile computing in higher education, this study investigated college professors' perceptions on mobile computing, and also the correlations of those perceptions with the college professors' teaching methods, teaching styles, technology adoption stages, and mobile computer use in the classroom.

In the first phase, the study employed a survey questionnaire of 17 questions. The independent variables were professors' teaching methods, teaching styles, technology adoption stage, and professors' mobile computer use in the classroom. The dependent variables were advantages and disadvantages of mobile computing. In addition, the study also assessed the professors' "*Post-modernism Professionalism*" to measure the influence of mobile computing on work style and rhythm.

Four Null Hypotheses were used in the first phase of the study:

Null Hypothesis 1: Respondents' teaching methods do not correlate with their perceptions on the advantages and disadvantages of mobile computing. The teaching methods were based on Grasha & Yangarber-Hicks (2000).

Null Hypothesis 2: Respondents' teaching styles do not correlate with their perceptions on the advantages and disadvantages of mobile computing. The teaching styles were based on Grasha & Yangarber-Hicks (2000).

Null Hypothesis 3: Respondents' stages of technology adoption do not correlate with their perceptions on the advantages and disadvantages of mobile computing. The technology adoption stages were were based on Dwyer, Ringstaff, and Sandholtz (1990).

Null Hypothesis 4: Respondents' mobile computer use does not correlate with their perceptions on the advantages and disadvantages of mobile computing.

The survey yielded 31.9% of the target population of 94 professors. This percentage was sufficient for statistical analysis, such as building a normal distribution (Howell, 1997), but the power of this sample size was not very strong for developing external validity and therefore the findings of this study are not statistically generalizable.

Correlation between independent variables and dependent variables

Statistical analysis was employed to investigate the correlation between four independent variables and two dependent variables. The independent variables were respondents' teaching methods, teaching styles, technology adoption stages, and mobile computer use in the classroom. The two dependent variables were respondents' perception of advantages and disadvantages of mobile computing.

There were no significant Pearson *r* correlations between respondents' teaching styles and technology adoption stages, and their perception of the disadvantages of mobile computing. This meant that respondents' perception of the disadvantages of mobile computing were not significantly correlated with what teaching style they used and how they used computer technology in their classrooms.

There were significant Pearson *r* correlations between respondents' teaching methods and both the advantages and disadvantages of mobile computing; between respondents' teaching styles and the advantages only; between respondents' technology adoption stages and the advantages only; and finally, between respondents' percentage of class time of mobile computer use and both the advantages and disadvantages of mobile computing.

All respondents agreed with all advantages of mobile computing, regardless their teaching methods, teaching styles, technology adoption stages, and percentage of class time using mobile computing. However, overall there

were three disadvantages with which respondents' mean score of agreement of those disadvantages was above 2.5 for the scale of 1 to 4 where 1 was strongly disagree and 4 was strongly agree were: "*too many e-mails to read," "lack of time for personal activities,"* and *"mobile computing is unreliable/easily break."* Professors in the case study added that mobile computers also created distractions because the students could open instant messaging or communicate by e-mails. The professors reported that when students were engaged in these activities, they were not paying attention to the lectures, as expressed by professor A, C, and D. However, some professors in the survey and professor B and D in case study were not bothered by this behavior, hence it did not reach the level of agreement reported for the three disadvantages.

Teaching methods and perceptions

Null Hypothesis 1 theorized that respondents' teaching methods would not correlate with their perceptions on the advantages and disadvantages of mobile computing. The analysis of variance among five teaching methods and the advantages and disadvantages was not significant. However, Pearson *r* correlation analysis showed that "*Lecture*" method has two negative significant *r* correlations with advantages "*collaboration in a common experience*" and "*improve professor-student communication.*" Nine professors or 30% of respondents in the survey and three out of five professors in the case study, professor A, D, and E, selected "*Lecture*" method. "*Discussion*" method has a

positive significant *r* correlation with advantage "*increase enthusiasm for teaching*." In the survey, six professors or 20% of respondents selected "*Discussion*" method. "*Students work on project*" method has a negative siginificant *r* correlation with one disadvantage: *"[mobile computer] is too expensive*." Seven professors or 23.3% of respondents in the survey and professors B and C in the case study selected "*Students work in projects*" as their teaching style Therefore, Null Hypothesis 1 was rejected.

"*Lecture*" is a common practice in teaching, but the amount of class time allocated for it varies widely. They employed mobile computing technology in the classroom to support their existing teaching methods. For example, they utilized wireless laptop for lecturing with Power Point presentation. *"Lecture"* method can be described as a teacher-centered method that, according to Grasha (2002), puts teacher as the main source of subject matter in the classroom and the professor could cover certain amount of information in a specific time, as shown by professor A, D, and E in their observed class meetings. Johnson, Johnson & Smith (1991) reported that lectures that keep students more actively engaged intellectually are those that have focused discussions before and after the lecture. Professors who selected "*Lecture*" method did not think that mobile computing provided advantages "*collaboration in a common experience*" and "*improve professor-student communication*" because they kept using "*Lecture*" in its one-way communication technique, instead of adding it with discussion or classroom exercise. In fact, Johnson et.al. cautioned that when using these

combinations, professors must make the instructions and task explicit and precise and that he or she requires the groups produce a specific product out of that lecture session. "*Lecture*" required professor's preparation and students' full attention in a face-to-face interaction in the classroom. The one who applied this method did not think that mobile computer would improve communication with students. Instead, those professors thought that the mobile computer might create new problems, for example students did not pay attention to the lecture because they were busy with e-mails, games, or instant messages.

Kulik & Kulik, (1979) and McKeachie, Pintrich, Yi-Guang, & Smith (1986, 1988) reported that "*Discussion*" method was more favorable over "*Lecture*" when the method involved measuring the transfer of knowledge to new situations, or measures of problem solving. Furthermore, Costin (1972) and Johnson, Johnson & Smith (1991) found that "*Discussion*" method was better than "*Lecture*" in improving attitude and motivation for further learning. The case study found that professor E who selected "*Discussion*" method in the survey was practicing "*Lecture*" method instead because, as the professor reported, there were many topics to be taught to the students in that semester.

Although Grauerholz, McKenzie & Romero (1999) stated that "*Students work in projects*" method was common for technologically rich classroom, this study found that the number of professors who chose this method were not the majority because the mean plots data also showed that these professors did not think mobile computing could help students collecting data in the field. The

professors might think that the students still need their guidance to acquire important data. However, mobile computing was perceived as helpful in working on projects, exercises, and assignments because this method has negative correlation with disadvantage *"[mobile computer] is too expensive*," which means the professors who employed this teaching method did not think that mobile computing has supported their method and the benefit of using the technology surpassed the cost. The price of a wireless laptop computer like the one that was used in Suburban State College at the time of this investigation was $1,309 plus tax and shipping. The professors thought the price was reasonable and affordable considering the median household income of families in the area was around $54,000 (US Census Bureau, 2000). Indeed, laptop computer has become cheaper with more features, so the computer owners did not need additional gadgets to work on their computers.

Cuban (2001) used "rampant featurism" as a term to illustrate how the industry has been adding more functions and features in computers that were too many for users. Users usually then left those functions unutilized. In this study, the most frequently used functions were wireless connection, Internet browser, e-mail, Power Point, Word processing, Excel spreadsheet, and windows media player. Blackboard.com that hosted courses web sites offered 12 capabilities from syllabus writing to virtual classroom. Professors who participated in the case study did not use all of them, the most common capability used were on-line

quizzes, on-line course materials, and group folders. The features in the laptops and Blackboard server were too many to be utilized for teaching and learning.

Mobile computer also did not make the professors feel lonely. On the other hand, mobile computer has enabled them to communicate with students, colleagues, or friends. This finding did not support previous studies that found mobile computing made teachers feeling lonely (Oppenheimer, 1997; Kraut, Lundmark, Patterson, Kiesler, Mukopadhyay, & Scherlis, 1998; Rosenberg, 1998).

"*Discussion*" and "*Students working on Project*" methods required students to work with other students and their professor as well so in this situation, mobile computing improved the possibility of collaboration. The professors could also keep track of the students work and projects because students could save and submit their works more easily to their professors. Mobile computer in these two teaching methods could help professors delivering broad sources of information that would enriched the students' experience in classroom learning, and keep students engaged in the learning activities, as cited by Johnson et.al (1991). The study also confirmed that mobile computing has changed the dynamics of a classroom into more discussion, inquiry, and cooperative learning as reported by Simonsen & Dick (1997).

Mean scores of agreement showed that some respondents disagreed with some of the advantages. Professors who chose "*Lecture*" and "*Other/All of them*" teaching methods agreed with four disadvantages: (1) "*too many e-mails*

to read," (2) "*need additional training*," (3) "*mobile computer is unreliable/easily break*," and (4) "*limited battery life*." E-mails have become part of professors' daily activity. Indeed, e-mails helped students to communicate with professors without making any appointment. However, this convenient communication tool has also created additional burden for professors such as checking e-mails from students everyday both at home and on campus. Oppenheimer (1997) and Rosenberg (1998) stated that mobile computing has changed professors life style because of constant attention to e-mails and on-line discussions. In addition, some professors expressed concern that they need additional computer training in order to use mobile computer better. Cuban, Kirkpatrick, and Peck (2001) found that teachers not only need additional training, but trainings that were related to the curriculum and their teaching materials. They also suggested training should be conducted in a convenient time for them. Hence, it is suggested that training in the use of mobile computing may be necessary and that such training should be conveniently scheduled and combined with useful and realistic curriculum objectives.

The survey and case study found that professors who participated in this study perceived mobile computers as "*unreliable/easily break*." Fourteen respondents or 46.6% of all respondents agreed with this disadvantage and three participants in the case study mentioned unreliability of wireless laptop computers in class works, especially if the professors needed the students to go on-line at the same time. "*Limited battery life*" was also an important

disadvantage. There was a necessity to plug in and re-charge a computer's battery after a few hours of use. At the time of the study, there was no solution that allowed professors and students to use mobile computing continuously without re-charging battery in the classrooms. In one observation in professor A's classroom, almost all students with wireless laptop computers sat on the one side of the classroom because they needed to plug into the wall outlets along the side of the classroom. This situation created an unbalanced distribution of students in the classroom. No previous studies cited the unreliability and limited battery life as disadvantages of mobile computing. This finding showed the somewhat surprising need for a supporting infrastructure of having an electrical plug for each student in a classroom where all students were using mobile computing. Battery life is also a concern and should be considered when purchasing laptop computers: the longer the better.

Teaching styles and perceptions

Null Hypothesis 2 postulated that respondents' teaching styles did not correlate with their perceptions of the advantages and disadvantages of mobile computing. The Pearson *r* correlation analysis showed that there were some significant correlations between professors' teaching styles and their perceptions on mobile computing. Therefore, Null Hypothesis 2 for the advantages was rejected. This finding supported a study by Grasha (2003) that found teaching

style was an important factor in determining professor's roles, attitudes, and behaviors.

The Pearson *r* correlation tested whether two variables were significantly correlated. The score of *r* can be –1.00 or +1.00. The study found 11 significant correlations between respondents' teaching styles and the perceived advantages of respondents' perceptions of mobile computing. The correlation calculation showed that "*Expert*" and "*Formal Authority*" teaching styles produced seven negative correlations with seven advantages of mobile computing. The negative correlation meant that the higher the respondents rated the "*Expert*" and "*Formal Authority*" teaching styles, the lower they rated the advantages. "*Expert*" style has negative correlation with three advantages: (1) "*constant accessibility*," (2) "*collaboration in common experience*," and (3) "*improve professor-student communication*." The three advantages described a process-oriented pedagogy. "*Formal Authority*" style has negative correlation with four advantages: (1) "*provide higher quality students material*," (2) "*improve efficiency and organization*," (3) "*increase confidence and computer skill*," and (4) "*design assignment that meet students need*." The four advantages described a product-oriented pedagogy. Grasha (2003) explained that professors who practiced "*Expert*" and "*Formal Authority*" usually tended to employ one-way communication from them to their students. Computer that was able to connect to other sources of information could be a threat to the professors' authority. Grasha added, the primary concern of professors with "*Expert*" and "*Formal*

Authority" styles was information transmission and an assertion that the learners were well-prepared.

"Personal Model" style has one positive correlation with advantage "*collaboration in common experience*." Professors who practiced *"Personal Model"* perceived mobile computing allowed them to share their experience more easily through telling a personal experience story in the middle of lecture, as demonstrated by professor E in the case study. They did not perceive themselves as the only source of information, but thought that students would get the benefit from them through real-life cases. Grasha (2003) described that "*Personal Model*" style as reflecting the need to help students as they work collaboratively with the professor.

Faculty who selected "*Facilitator*" style showed positive correlation with perception of advantages "*better record keeping*" and "*improve professor-student communication.*" "*Delegator*" style has positive correlation with "*improve professor-student communication.*" "*Facilitator*" and "*Delegator*" teaching styles represented student-centered approaches for developing students' capacity for self-direction and autonomy.of their experience (Grasha, 2003). The survey results revealed that professors were able to adapt mobile computing to their preferred pedagogical styles. From both survey and case study, professors with the two styles demonstrated their disagreement with disadvantage "*too many e-mails to read*" because they did not mind to receive, read, and respond to students' e-mails.

The Pearson *r* correlation analysis showed that there was no significant correlations between professors' teaching styles and their perceptions of disadvantages of mobile computing. Therefore, Null Hypothesis 2 for the disadvantages was accepted. Professors in this study selected disadvantages of mobile computing without any significant relationship with their teaching styles.

Technology adoption stage and perceptions

There were significant correlations between technology adoption stage and advantages of mobile computing. Therefore, Null Hypotheses 3 for advantages was rejected. There was no significant correlation between technology adoption stage and disadvantages. Therefore, Null Hypotheses 3 for disadvantages was accepted.

The highest correlation was between "*Invention"* stage and advantage "*increase enthusiasm in teaching*" suggesting that participating professors who rated themselves at the "*Invention*" stage, highest level of technology adoption stage, strongly agreed that mobile computing increased their enthusiasm for teaching. Certainly, in this stage, the professors had been using computers for some time and they were confident and enthusiastic in using computers. According to Dwyer, Ringstaff, & Sandholtz (1990) and Whittier & Lara (2003), teachers who tend to adopt technology quickly are usually those who feel comfortable with active, student-centered methodologies. Professors in this stage indeed chose student-centered teaching method, such as "*Students work on project*," and student-centered styles, such as "*Delegator*" and "*Facilitator*"

styles. In the "*Invention"* stage also, the correlation between technology adoption stage and advantage "*increase efficiency and organization*" was also significant, suggesting that respondents in "*Invention"* stage thought that mobile computing has enabled them to increase efficiency and organization of their works.

One stage lower from "*Invention*" is "*Appropriation*" stage. The correlation of respondents who claimed to be in "*Appropriation"* stage and advantage "*improve professor-students communication*" was also significant, suggesting that the professors who were in "*Appropriation"* stage agreed with the advantage of mobile computing in improving professor-student communication. The next lower stage from is "*Adaptation.*" The correlation of respondents in this stage with advantage "*improve data collection in the field*" was also significant, suggesting that professors who were choosing "*Adaptation*" stage agreed on the advantage of mobile computing in improving data collection in the field.

Dwyer, Ringstaff, and Sandholtz (1990) reported that teachers moved gradually from lower stage to the higher stage. This study confirmed this findings. Suburban State College has been implementing campus-wide policy that required all students to own wireless laptop computer since fall 2002 semester. At the time of this study, the students at the college have been using the technology intensively for one year, and yet the study showed that the participating professors demonstrated a gradual upward movement in technology adoption stage: only four significant correlations between their five technology adoption stages and 11 advantages of mobile computing.

Professors' mobile computing use and perceptions

There were two significant Pearson *r* correlations between professors' mobile computer use and two advantages, one significant correlation between professors' mobile computer use and a disadvantage of mobile computing. Therefore, Null Hypotheses 4, "*respondents' mobile computer use did not correlate with their perceptions of the advantages and disadvantages of mobile computing*," was rejected.

Mobile computer use in the classroom and perceptions

The correlation between professors' mobile computer use "*Less than 5% of class time*" and advantage "*improve student learning*" was negative significant. This means that professors in this group did not think that mobile computing could improve student learning. The strong correlation provided a speculation that the professors might think that mobile computer did not improve student learning, therefore they did not use the technology more often in the classroom. Cuban (1986) and Dockterman (1988) suggested that teachers would only use technology in their classroom if they thought that the technology could improve their existing pedagogy.

The correlation of professors' mobile computer use "*Between 26%-50% of class time*" and advantage "*increase enthusiasm for teaching*" was positive significant. This again confirmed the findings of Dwyer, Ringstaff, & Sandholtz (1990) and Whittier & Lara (2003) that the more the professors using technology, the more enthusiastic they are in teaching because they feel more comfortable

with technology that could help them do their job better than teaching without the technology. However, the correlation of professors' mobile computer use "*Between 51%-75% of class time*" and disadvantage "*feeling lonely and isolated*" also was also positive significant. It may be then, that enthusiasm might be diminishing, and replaced by loneliness feeling as the amount of computer use increases, a finding also reported by Oppenheimer (1997), Kraut, Lundmark, Patterson, Kiesler, Mukopadhyay, & Scherlis (1998), and Rosenberg (1998).

Fourteen professors or 46.7% of respondents who participated in this study at Suburban State College chose a percentage of mobile computer use ranging from 6% to 25% of class time. It was interesting to see how these professors utilized mobile computer technology in very limited amounts of class time because all buildings on the campus have wireless network ready, students and professors have wireless laptops, and many courses have web sites on the Blackboard.com. Indeed, this finding corresponded to Cuban's study in 1998-1999 on teachers and professors at schools and colleges in the San Francisco Bay Area that demonstrated limited computer use in the classroom (Cuban, 2001). In the case of Suburban State College, a college-wide policy that required students to own wireless laptop computers was implemented in the fall 2002, and the policy was expected to increase the use of mobile computing in the classrooms. However, 14 professors, or almost half of respondents, who taught courses that required students to own wireless laptops utilized mobile computer

only between 6%-25% of class time. Classroom observations of the participants in the case study help to explain this finding.

In the case study, Professor A and E chose a similar percentage. Professor A explained that the unexpected network failures or limited power plugs in some classrooms made the professor hesitate to use laptop more often. Indeed, the professor had a lab time once a week when the students could work on the desktop computers in the lab to catch-up with the course materials. On the other hand, Professor E taught a course that did not require students to own laptop computers. The college provided the wireless laptop computers for students in some sessions when the students needed the computers for doing their exercises. Professor E reported that he or she would love to use the laptops more often but not all of the course materials were ready in digital format, such us Power Point files or html pages (Personal communication, December 2003). This, and other findings in this study, pointed out a major variable in implementing the effective use of mobile computing: Suburban State College had helped students acquiring mobile computing but had not built up the infrastructure necessary to use in classrooms.

The professors believed that mobile computing was very helpful in presentation and e-mail. This finding can be connected to the advantages of mobile computing "*increase professor-student communication*" and "*provide higher quality of students materials.*" These advantages indeed got high rates of agreement from 14 respondents or 46.7% of total respondents who used mobile

computing in the range of 6%-25% of class time. So, the majority of professors who partcipated in this study perceived positively on the use of mobile computing in Suburban State College, especially in improving professor-student communication and improving their ability in providing higher quality of students materials. Nevertheless, two professors who used mobile computer less than 5% of class time and 14 professors who used mobile computer between 6%-25% of class time agreed with two disadvantages: "*need for additional training*" and "*mobile computer is unreliable and easily break.*" Those professors had started using mobile computers in the classroom and therefore reported that they needed more training to improve their ability in using computers. They also reported that mobile computer was unreliable and easily break because they experienced with problems with Internet connections during class time.

Two professors who employed mobile computer less than 5% of class time disagreed with four advantages of mobile computing. The professors reported that mobile computing: (1) "*Did not increase efficiency and organization*," (2) "*Did not increase enthusiasm for teaching*," (3) "*Did not improve student learning*," and (4) "*Did not improve their ability to design assignments to meet students need.*" On the other extreme, two professors who used mobile computer more than 76% of class time agreed with three advantages: (1) "*constant accessibility*," (2) "*increase confidence and computer skill*," and (3) "*improve data collection in the field.*" This study showed that the

professors did not use technology in their classrooms very often because they thought the technology did not help their teaching practice.

Making mobile computing available in the classrom had increased the access to technology, but without adapting it to the professors' teaching practice, the easy access would be wasted because the professors did not see the advantage of mobile computing in supporting their teaching process. This finding provided additional condition to the finding of Apple Classroom for Tomorrow study that constant and easy access to computer technology was important for teachers to make them comfortable using the technology for teaching and learning in the classrooms (Dwyer, Ringstaff, and Sandholtz, 1990). This study found that constant accessibility does not guarantee teacher's likeliness to employ technology, but how the technology allows teacher's control and enriches learning materials that supports teacher's practice does.

In mean plots of mobile computer use in the classroom and disadvantages, three professors who used mobile computer between 51%-75% of class time agreed with seven disadvantages: (1) *too many e-mails to read*, (2) *feeling lonely and isolated*, (3) *need for additional training*, (4) *too expensive*, (5) *too many accessories needed*, (6) *limited battery life*, and (7) *low quality wireless connection*. Three professors in this group also agreed that mobile computing did not improve collaboration in common experience and did not improve their ability in record keeping.

Mobile computer use outside of the classroom and perceptions

Every week, respondents spent almost 18.5 hours for off-line work using their computers and 12.5 hours for on-line work. In total, they worked in front of computer for 31 hours per week. A national survey showed that in fall 1998, full-time faculty worked on average 53.4 hours per week (US Department of Education, 2001). The national survey defined work as coming to on-campus office and teaching. There was no national survey on the faculty's time for mobile computing activities outside of the classroom. Does this mean that mobile computing makes the professors work longer hours? It might be, because in the case study, Professor A reported working for almost 80 hours per week -- 43 hours off-line and 37 hours on-line. This was extraordinary because the 1998 national survey showed that on average professor worked only 53.4 hours per week.

This study showed that professors were still working within the period of 6:00 A.M. to 6:00 P.M. during both typical weekdays and weekends (Figure 17). It also provided an indication that the professors at Suburban State College also worked both on campus and at home, but rarely worked outside of the two places (Figure 18). This finding indicates that, in terms of time, the participating professors worked outside of their "normal" working hours, and in terms of place, outside of classroom and off-campus. The survey showed that these professors' activities outside of working hours include checking and responding to students' e-mails, writing handout with wordprocessor, preparing lectures with Power

Point, and searching learning materials that support their lectures from the Internet.

Distraction as one of the disadvantages of mobile computing

Distraction happens with or without the technology. The study demonstrated that some professors who implemented "*Expert*" and "*Formal Authority*" teaching style tended not to tolerate students engaging in activities other than what the professors asked them to do in the classroom. These professors did not want to lose their control on the classroom because they perceived themselves as the legitimate source of knowledge. This finding was consistent with Grasha (2003) finding that professors who practiced "*Expert*" and "*Formal Authority*" style would always try to transmit information in a didactic matter and their concern was students' full attention to the class. Previous studies by Cuban (1986), Dockterman (1988), and Dwyer, Ringstaff & Sandholtz (1990) found that teachers perceived technology that did not support their practice as a threat, if not a distraction.

This study, however, found that some professors who employed student-centered teaching method and style, such as "Students work on projects", would usually tolerate students to do multitasking, although the activities might be just instant messaging, browsing the Internet, or e-mailing. Those who achieved higher ACOT stage such as "*Appropriation*" and "*Invention*" stages, and who used mobile computer more than 5% of class time were also more more tolerant of the students' off task activities in the classroom.

Discussion on the professors' expression on post-modernism professionalism

The study also found that professors worked extra hours outside of the classroom. The survey showed that on average 77% of respondents worked on campus and spend time working on computer between 6:00 AM to 6:00 PM during the weekdays. In the next time slot, from 6:00 PM to 12:00 AM midnight, on average 57% of respondents still worked on their computer although this time they were working at home. Between midnight and 6:00 AM, there were 6.7% of respondents who still worked on the computer. The work pattern on weekends was similar to weekdays, although the place of working on computer was home instead of campus.

The case study examined further the reasons behind professors' computer use pattern. The five professors who participated in the case study worked on computer on three six-hour sessions every weekday and weekend. Although it did not mean that the professor worked for 18 hours, it showed that these professors consistently worked on computers in the morning, in the afternoon, and in the evening. Some of them even worked between midnight and early morning. This finding is consistent with a study by Fisher (1999) that mobile computing had made teachers or professors work more time beyond their working hours, both on-campus and at home. Professors in this study worked 31 hours per week on their computer, in addition to their research and teaching activities. The blurred boundary between work and home that has happened has forced professors to consider reducing the workload or at least putting a limit on

the students' e-mails. The most common activities in the off-campus night and weekend time periods were replying to students' e-mails and preparing presentations.

The findings of the many hours the participating professors worked at home on nights and weekends lead to the conclusion that the professors who participated in the case study can be deemed practicioners of so-called "*Post-modernism professionalism.*" The classroom observations and interviews showed that they practiced seven principles that were coined by Hargreaves and Goodson (1996). Using the case study results, the five professors' expressions were matched with the seven principles (Table 42). Fisher (1999) concluded that the seven principles imply high levels of individual agency, that is, "the power of the individual to do things and to effect change" (p. 5). He found that portable computers could help teachers experience the nature of post-modernism that is flexible, adaptable, sensitive to context, and non-prescriptive.

The seven principles have seven foci: students, colleagues, community, moral and social values, caring, long-life learning, and complex task. Any college professor will perceive those foci as important although he or she might not be using mobile computing in their teaching practice. Therefore, the seven principles of "*Post-modernism professionalism*" can be practiced by any teacher or professor regardless of whether they use technology implementation in the classroom. Nevertheless, the seven principles are useful in explaining the state of mind of college professors who participated in the survey and the case study.

Questions such as "Do they teach their students with care and more than just a routine day job?" describes the characteristics of the "*Post-modernism professionalism*." The professors in this study demonstrated that they did care about the students and did not mind to work extra to help them comprehend the subject matter and complete assignments.

Table 42. Five professors were implementing the seven principles of Post-modernism Professionalism

The seven principles	Focus	This study found
1. Increased opportunity and responsibility to exercise discretionary judgment over the issues of teaching, curriculum and care that affect one's students	Student	Professors employed different methods to find the right strategy to make the students learn the course better.
2. Opportunities and expectations to engage with the moral and social purposes and value of what teachers teach, along with major curriculum and assessment matters in which these purposes are embedded	Moral & Social	The professors unintentionally sent messages to students about moral and social values
3. Commitment to working with colleagues in collaborative cultures of help and support as a way of using shared expertise to solve the ongoing problems of professional practice, rather than engaging in joint work as a motivational device to implement the	Colleagues	The professors had been actively involved with academic and professional circles, which demonstrated the professor's intention to keep in touch with progress in the field in a collaborative way
4. Occupational heteronomy rather than self-protective autonomy, where teachers work authoritatively yet openly and collaboratively with other partners in the wider community (especially parents and students themselves), who have a significant stake in th	Community	The professor showed the willingness to learn from students and let the students work with their colleagues to improve the quality of the learning process.
5. A commitment to active care and not just routine service for students. Professionalism must in this sense acknowledge and embrace the emotional as well as the cognitive dimensions of teaching, and also recognize the skills and dispositions that are es	Caring	The professor taught meditation or other non-course materials to enrich the students' learning experience.
6. A self-directed search and struggle for continuous learning related to one's own expertise and standards of practice, rather than compliance with the enervating obligations of endless change demanded by others (often under the guise of continuous learn	Life-long learning	The professor's expression demonstrated a motivation to keep up with new technology that affects the teaching and learning process.
7. The creation and recognition of high task complexity, with levels of status and reward appropriate to such complexity.	Complex Task	The professor used the term 'chaotic' for the many tasks that the class must accomplish that day. Yet, the professor could understand if students got lost and therefore the professor was ready to help students individually in comprehending the course materials

Nevertheless, an important question remains: "Is mobile computing technology causing them to practice "*Post-modernism professionalism*" principles, or the other way around: their practice of "*Post-modernism*

professionalism" makes them employ mobile computing technology?" This study did not answer this question because it did not investigate the professors' perceptions before starting to use mobile computing in the 1990's. Nevertheless, this study provided an indication that the professors who employed mobile computing were practicing "*Post-modernism professionalism*" principles.

CONCLUSIONS

The main research question was "*what do college professors perceive to be the pedagogical advantages and disadvantages of mobile computing in courses that require its use by students?*" The study showed that the most important pedagogical advantages of mobile computing were (1) improving professor-student communication, (2) encouraging collaboration in common experience where students learn in groups that would improve their teamwork skills, and (3) improvement in their capabilities as faculty in designing assignments that meet student needs. The pedagogical disadvantage was (1) too many e-mails to read.

The professors' teaching methods, teaching styles, technology adoption stage, mobile computer use in the classroom are significantly correlated with the advantages of mobile computing. Professors who selected teacher-centered method and style disagreed that mobile computing improved professor-student communication and facilitated collaboration in the classroom. Professors who perceived themselves as the source of information, the authority and the only expert in the classroom would ask students to pay attention to the class activity fully. This kind of professor would not tolerate students to engage in activities outside of what the professors suggested. The professors thought that the students needed to comprehend the course materials as directed by them and, therefore, instant-messaging, e-mailing, and browsing were not acceptable.

On the other hand, professors who selected student-centered method and style agreed with the two advantages, plus they disagreed with the perception that mobile computing was too expensive. The professors who perceived themselves practicing the "*Invention*" technology adoption stage – the highest level of adoption stage of Apple Classroom of Tomorrow (ACOT) study – perceived that mobile computing "*increased their enthusiasm for teaching*" and "*increased their efficiency and organization.*" Those who practiced "*Adaptation*" and "*Appropriation*" -- the third and fourth level based on technology adoption stages -- which were the majority among the participating professors at Suburban State College agreed with advantages of "*improved data collection in the field*" and "*improved student-professor communication.*"

The survey phase of this study found that many professors were working on the computer both at home and on campus. Some of them even worked beyond evening to early morning, and also during the weekend. The professors answered students' e-mails, prepared lectures or classroom activities, and graded students' work. In term of "*Post-modernism professionalism*" principles, professors who participated in this case study showed that their expressions and responses in interviews in some way matched with Hargreaves & Goodson's seven principles, leading to the conclusion that the professors in this study did practice the seven principles. However, this finding could not settle the causal relationship between the professors' "*Post-modernism professionalism*" practices

and their use of mobile computing. They may have practiced these principles without mobile computing.

Recommendation for further research

To complement this study, an evaluation of student learning outcomes and faculty teaching effectiveness is necessary to investigate the advantages and disadvantages of mobile computing in the classroom. An experimental model that compares the outcomes of student learning and the effectiveness of faculty teaching would elaborate further the benefits of mobile computing and its relationship with learning and teaching process.

Expanding this study to a larger population, including other colleges in other regions of the United States, would work toward making the findings generalizeable. The study must also be conducted when there are significant advances in mobile computing technology. Continuous observation that could track the changes in professors' and students' perceptions of mobile computing may be appropriate to understand the evolving relationship between education and mobile computing.

Further research also should include students as respondents of the survey and as participants of the case study because students' perceptions of mobile computing is equally important to understand the full impact of mobile computing. Furthermore, the advantage of mobile computing for improving student learning can be corroborated with this further study. By understanding

both the teacher's side and the side of people who receive the teacher's service, we can utilize technology for better teaching practices.

Further, perhaps longitudinal study could track whether the professors will move up to higher levels in technology adoption stage. This will help researchers in the field of educational technology assess the cause of college professors movement along the technology adoption stages more accurately.

The concept of teaching professionalism needs to be refined and perfected by doing more research on teachers and their working environment. Fisher (1999) suggestion that "*Post-modernism professionalism*" was the result of mobile computing use needs to be investigated further, especially its causal relationship between the teacher's professional values and the use of technology. The use of mobile computing technology or other kinds of technology in teachers' jobs will influence the teaching and learning process and eventually the teaching profession itself. However, the magnitude of this influence on the profession needs to be assessed because technology might be a blessing or a curse. Using technology without proper research and valid evidence will end up with financial lost, missed opportunities, and wasted time.

Further study could consider the professors' voluntary report on their daily computer activities although some might think this was an invasion of their privacy. By knowing the professors' computer activity, we can acquire data about the most used programs, the rhythm of their work schedule on and off-campus, and the trend of computer use among professors in the near future.

This type of information could help administrators to spend their technology money more wisely.

The future of mobile computing depends upon many factors and actors. The most important factor is how the technology can serve classroom practice and support learning. Mobile computing is certainly better than calculator because it has many functions that combine communication and computing abilities. The communication function helps professor or teacher in dialogue with students, colleagues, and parents. The computing function helps professor or teacher to organize the subject matter, to prepare lecture, discussion, or other methods in the classroom, and to create more opportunities for assessment on students academic achievement. Educators and educational technologists can guide the development of mobile computing technology toward functionality in teaching and learning, not unnecessary features, accessories, and gadgetry. This brings us to the most important actor in this endeavor: the teacher or professor. Many studies including this one found that the implementation of educational technology, such as mobile computing, in the classroom must involve teachers and professors.

The focus of this study was faculty perceptions of mobile computing, not an external evaluation of faculty effectiveness or an assessment of student learning. Yet, this study leads to the conclusion that constant accessibility is not enough to encourage professors to utilize mobile computing technology. This

technology must be adjusted and adapted to a professor's teaching styles and methods as well as their capability in utilizing the technology.

In sum, this research supports the conclusion that mobile computing was perceived as an advantage to faculty in improving higher education in this investigation. Further, this research supports the conclusion that financial resources devoted to mobile computing in higher education should be devoted to flexible hardware and software instruments and to training and supporting faculty time in adapting those instruments to each faculty's preferred teaching practices.

APPENDICES

APPENDIX 1: COVER LETTER OF SURVEY QUESTIONNAIRE

Study of College Professors' Perception on Mobile Computing

Dear college professors:

I would like to thank you in advance for your participation in this study. You are invited to participate in a research study on the college professors' perception of the use of mobile computing devices in their courses. There are five types of questions: multiple choice, yes or no, Likert scale, fill in the blank, and short essay. The purpose of the study is to acquire comprehensive opinions from college professors regarding the use of mobile computing devices in their courses. You will be asked to fill out the questionnaire thoroughly.

Your participation is voluntary and you have the right not to participate in this study. Your individual privacy will be maintained in all published and written data resulting from the study. Only the researcher knows the raw data.

The survey questionnaire is due September 30, 2003 (although, you may send this survey pass this date if you are very busy by then).

In conjunction with this survey, I will also conduct a case study. If you are interested in participating in this study as well, please contact me at anytime. As a participant of this case study, you will be asked to involve in three parts: (1) as a participant for interview, and (2) as a participant of a direct observation in your class. The purpose of the study is to get comprehensive opinion from college professors regarding the use of mobile computing devices in their courses.

I thank you for your participation in this study. Send the completed survey to:

Totok Soefijanto
Candidate of Ed.D., Boston University School of Education
22 Laurel Street # 33, Somerville, MA 02143
Telephone: (617) 625-9358; E-mail: totok@bu.edu

Dissertation first reader and academic advisor:
Dr. David Whittier; E-mail: whittier@bu.edu
Educational Media & Technology Program
Boston University School of Education
Two Sherborn Street, Boston, MA 02215

APPENDIX 2: THE SURVEY QUESTIONNAIRE

Study of College Professors' Perception on Mobile Computing

Before start, please write down the initials of your name here: _ _ _
(For example: write ***AFN*** for Alfred F.Nobel)

A. BACKGROUND

1. How old are you now?
   a. Younger than 30.
   b. Between 31-40.
   c. Between 41-50.
   d. Between 51-60.
   e. Older than 60.

2. Gender (check the box): Male Female

3. How many years have you been using computer? .....years.

4. How many years have you taught?
   a. Less than 5 years.
   b. 6-10 years.
   c. 11-15 years.
   d. 16-20 years.
   e. More than 21 years.

B. PEDAGOGY & TECHNOLOGY

5. When (month/year) did you start using mobile computing devices for the first time?
   ...../.....

6. List the course(s) you teach in this semester by course number and title:
   1. .....
   2. .....
   3. .....
   4. .....

7. What kind of teaching method do you like the most (circle one ONLY):
   a. Lecture
   b. Discussion
   c. Student(s) lead the class
   d. Student(s) work on project(s)
   e. Other, specify: .....

8. Rank the following statements that best represents your strategy in using computer for teaching and learning in your classroom(s). Write 1 to the style that is MOST like you and 5 to the style that is LEAST like you.
   — Integrate new technology into traditional classroom practice.
   — Learn the basics of using technology.
   — Focus on cooperative, project-based and inter-disciplinary work.
   — Discover new uses of technology tools.
   — Use new technology to support traditional instruction.

9. On average, for what percentage of class time do you use mobile computing devices?
   a. Less than 5%.
   b. Between 6-25%.
   c. Between 26-50%.
   d. Between 51-75%.
   e. More than 76%.

10. Rank the following teaching styles that best represents your style. Write 1 to the style that is MOST like you and 5 to the style that is LEAST like you.

   — I believe in "teaching by personal example". I oversee, guide, and direct by showing how to do things and encourage students to observe and then to emulate my approach.

   — I strive to maintain status as an expert among students by displaying detailed knowledge and by challenging students to enhance their competence. I like students are well prepared.

   — I provide feedback, establish learning goals and rules of conduct for students. I describe the acceptable ways to do things and provide students with the structure they need to learn.

   — I encourage students to become self-directed, self-initiating learners. The students work independently on projects or part of teams. I am available as a consultant and resource person.

   — I emphasize the personal nature of teacher-student interactions. I work with students on projects in a consultative fashion and tries to provide as much direction and support as possible.

C. PERCEPTIONS

11. What tasks do you accomplish with the help of mobile computing devices for the course(s) you teach? (Circle the number that indicates your perception on each activity).

	Most helpful			Not helpful
a. Presentation.	4	3	2	1
b. Internet research.	4	3	2	1
c. Handout and syllabus writing.	4	3	2	1
d. Writing quiz, test, and assignment.	4	3	2	1
e. Grading and student evaluation.	4	3	2	1
f. E-mail.	4	3	2	1
g. Chatroom or on-line discussions.	4	3	2	1
h. Administration, letters, and memos	4	3	2	1
i. Reading news	4	3	2	1
j. Data processing.	4	3	2	1
k. Graphic design.	4	3	2	1
l. Record keeping.	4	3	2	1
m. Playing games.	4	3	2	1
n. Learning how to use software applications	4	3	2	1
o. Using databases.	4	3	2	1
p. Other; please specify:.....	4	3	2	1

12. How do you spend your time with mobile computing devices outside of the classroom in a week?
(Your activities will be divided into two categories: off-line and on-line. Measure them in hours; if less than one hour, use the fraction such as .3, .5, .7 and so on)

a. OFF-line activities
- Writing lesson plan(s) .....hours
- Writing handouts .....hours
- Writing memo or other administrative letters .....hours
- Writing quizzes or tests .....hours
- Evaluating and grading papers, assignments .....hours
- Writing research report .....hours
- Preparing presentation .....hours
- Learning new software .....hours
- Playing games .....hours
- Other; please specify: .....hours

b. ON-line activities

- E-mail .....hours
- Internet research .....hours
- Reading news .....hours
- Chatroom/on-line discussion .....hours
- Getting pictures/images .....hours
- Getting sound files .....hours
- Getting video files .....hours
- Updating personal/professional web site .....hours
- Using databases .....hours
- Playing games .....hours
- Other; please specify: ....hours

13. What kind of advantages do you get from using mobile computing devices? (Circle the number that represents your perception)

		Agree			Disagree
a.	Constant accessibility.	4	3	2	1
b.	Collaboration in a common experience.	4	3	2	1
c.	Increase efficiency and organization.	4	3	2	1
d.	Increase enthusiasm for teaching.	4	3	2	1
e.	Increase confidence and computer skill.	4	3	2	1
f.	Better record keeping.	4	3	2	1
g.	Design assignments to meet student needs.	4	3	2	1
h.	Provide higher quality student materials.	4	3	2	1
i.	Improve professor-student communication.	4	3	2	1
j.	Improve data collection in the field	4	3	2	1
k.	Improve student learning	4	3	2	1

14. If you think there are more advantages of mobile computing that are not on the list above, please describe here:

.....

.....

.....

(please use the blank page behind this page if you need additional space to write)

15. What kind of disadvantages do you get from using mobile computing devices? (Circle the number that represents your perception)

		Agree			Disagree
a.	Lack of time for personal activities.	4	3	2	1
b.	Feeling lonely and isolated.	4	3	2	1
c.	Too many e-mails to read.	4	3	2	1

d.	Need for additional training.	4	3	2	1
e.	Mobile computing is unreliable/easily break.	4	3	2	1
f.	Limited battery life.	4	3	2	1
g.	Too expensive.	4	3	2	1
h.	Too many accessories needed.	4	3	2	1
i.	Low quality wireless connection	4	3	2	1

16. If you think there are more disadvantages of mobile computing that are not on the list above, please describe here:

.....

.....

..... (please use the blank page behind this page if you need additional space to write)

17. How do you use computer outside of the classroom in a typical 24-hour period during the weekdays?
(Please CHECK one that fits your situation).

A six-hour period	Place (Home, Campus, Other)			Word-processing	Power point	E-mail	Internet browsing	Chatroom/ On-line discussion	Notes (you may use extra paper)
	H	C	O						
06:00AM—12:00PM									
12:00PM—06:00PM									
06:00PM—00:00AM									
00:00AM—06:00AM									

18. How is your typical computer activity the weekends (Saturday and Sunday)?

A six-hour period	Place (Home, Campus, Other)			Word-processing	Power point	E-mail	Internet browsing	Chatroom/ On-line discussion	Notes (you may use extra paper)
	H	C	O						
06:00AM—12:00PM									
12:00PM—06:00PM									
06:00PM—00:00AM									
00:00AM—06:00AM									

Additional question:
This survey will be followed up with **interview** and **classroom observation**.
Would you like to participate? Yes / No
If yes, please write down your e-mail and phone number here:
E-mail : _____
Phone : _____
Comments : _____

APPENDIX 3: CONSENT FORM OF CASE STUDY SUBJECTS

Study of College Professors' Perception on Mobile Computing

For questions about the study, contact:

Totok Soefijanto
Researcher/Doctoral candidate

Office:
Boston University School of Education
Educational Media and Technology Program
2 Sherborn Street, Boston, MA 02215
Telephone: (617) 353-3181
Facsimile: (617) 353-3924
E-mail: totok@bu.edu

Home:
22 Laurel Street/Apt. #33
Somerville, MA 02143
Telephone: (617) 625-9358

DESCRIPTIONS OF THE STUDY:
You are invited to participate in a research study on college professors' perception of the use of mobile computing devices in their courses. There are three types of participations: (1) as a participant for interview, (2) as a participant for classroom observation, and (3) as a participant who records his or her computer activities in a journal for one week. The purpose of the study is to obtain better understanding of how college professors view the use of mobile computing devices in their courses. You will be asked to fill out the questionnaire thoroughly.

RISKS AND BENEFITS:
The risk associated with this study is very limited. You might experience some discomfort from questions that ask you to think about or reflect upon the past events related to your use of wireless computing, and from recording your daily computer activities in one week. Benefits that may reasonably be expected to result from this study are a better understanding of the advantages and disadvantages of mobile computing in college courses, a more comprehensive understanding of college professors' perception of mobile computing, and guidance for future study on mobile computing in college courses. You will be anonymous in the study report. Furthermore, your individual privacy will be maintained in all published and written data resulting from the study. Your decision whether or not to participate in this study will not affect your employment, tenure status, or other related status.

TIME INVOLVEMENT:
Your participation in this study will take approximately 30-45 minutes for the interview, approximately 2 hours for classroom observation, and as necessary during 7 days for the journal report.

PARTICIPANT'S RIGHTS:
If you have read this form and have decided to participate in this study, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty or loss of benefits. You have the right to refuse to answer particular questions.

If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact – anonymously, if you wish – the researcher's academic advisor:

Dr. David Whittier
Coordinator of Educational Media and Technology Program
Boston University School of Education
Two Sherborn Street, Boston, MA 02215

PARTICIPANT'S APPROVAL:
I have read and understood the information ob this Informed Consent Form, agreed to participate, and have received a copy of the Informed Consent Form.

Signature .....Date .....

I also give consent to be audiotaped and videotaped during this study.

Please initial: .....Yes ....No

APPENDIX 4: INTERVIEW PROTOCOL

The Study of College Professors' Perception on Mobile Computing

Background

1. Questions to the participant regarding:
   (a) Course title he or she teaches.
   (b) Number of students.
   (c) Teaching methods used (lecture, discussion, lab, etc.).
   (d) How long has she or he been teaching the course?
2. Is the participant using mobile computing devices in teaching the class?
   Prompt: Laptop? Notebook? Palm Pilot? Wireless?
3. When did the participant start using mobile computing devices?

ACOT stage, teaching style, and post-modernism professionalism phenomenon

1. Can you tell me how you know mobile computing?
   Prompt: Department colleague? Department chair? Dean? Conference? Friends? Other?
2. Have your teaching style changed with the use of mobile computing?
   Prompt: Favorite teaching style? Why? How the participants learn about the style?
3. How do you use mobile computing devices in your class? How about outside of the class?
4. Has your organization or class management changed with mobile computing?
5. Have you taken or had additional training beyond that offered by the college?
6. Would you like to see more training available to you? In what form?
7. Do you feel that the technical support for using mobile computing on-campus is reliable and dependeable? How about for off-campus use?

8. How does the participant communicate with students?
   Prompt: E-mail? Chatroom? How long? When? Where?
9. Do you feel computers has enhanced or detracted from the course?
10. What do you wished I would have asked?

Advantages and disadvantages

1. What do you perceive to be the advantages in the use of mobile computing in your course?
2. Can you elaborate on the advantages you just mentioned?
   Prompt: In what ways these advantages help you in teaching? Why do you think these advantages are very important? Etc.
3. What the future advantages likely to be?
4. Are there any disadvantages of mobile computing in your course?
5. Can you elaborate on the disadvantages you just mentioned?
   Prompt: Any specific experience that makes you think of the disadvantages? Why do you think these disadvantages are very important to be noticed?
6. What do you think of anytime-anywhere learning that mobile computing provides?
7. How do you think of mobile computing after observing its advantages and disadvantages?
   Prompt: Can advantages boost your enthusiasm in using mobile computing? Can disadvantages discourage you to use mobile computing devices further? Can you explain your answer?

APPENDIX 5: CLASSROOM OBSERVATION PROTOCOL

Study of College Professors' Perception on Mobile Computing

1. Ask permission from the participant.
2. Set up date and time of the observation.
3. Come 10 minutes before the class begins.
4. Sit in the back of the class or other spot that will not disrupt or distract the class session.
5. Use classroom observation checklist (adapted from Austin Community College, 2000).

Classroom Observation Checklist

Professor's Name : ..... Date :.....
Course observed :..... Starting Time :.....
Department :..... Ending Time :.....

Teaching Style : Provides well-designed materials?
Employs non-lecture learning activities? (i.e. group discussion, student-led activities)
Invite class discussion?

Employs other tools/instructional aids? (i.e. wireless technology, computer, video, LCD projector)
Delivers well-planned lecture?
Comments : .....

Teacher-Student Interaction: Solicit student input? Involves a variety of students? Demonstrate awareness of individual student learning needs? Open for students inquiry in 24/7 mode?

Comments : .....

6. Write down the starting and ending time of the class session.

7. Express gratitude to the participant for the opportunity to do observation on his or her class.

8. Leave the class.

9. Transcribe all records (video and audio files) into written report within one week after the observation.

APPENDIX 6

F table of analysis of variance (ANOVA) of *teaching methods* and respondents' perceptions of *advantages* of mobile computing

Significant if the following F score more than $F_{.05}(4,25)$= **2.76**

		Sum of Squares	df	Mean Square	*F*	Sig.
ADV-A	Between Groups	2.776	4	.694	**.507**	.731
	Within Groups	34.190	25	1.368		
	Total	36.967	29			
ADV-B	Between Groups	9.554	4	2.388	**2.569**	.063
	Within Groups	23.246	25	.930		
	Total	32.800	29			
ADV-C	Between Groups	4.467	4	1.117	**1.471**	.242
	Within Groups	18.222	24	.759		
	Total	22.690	28			
ADV-D	Between Groups	5.925	4	1.481	**1.706**	.181
	Within Groups	20.833	24	.868		
	Total	26.759	28			
ADV-E	Between Groups	4.262	4	1.065	**1.135**	.365
	Within Groups	21.595	23	.939		
	Total	25.857	27			
ADV-F	Between Groups	6.629	4	1.657	**1.814**	.159
	Within Groups	21.923	24	.913		
	Total	28.552	28			
ADV-G	Between Groups	4.667	4	1.167	**1.250**	.316
	Within Groups	23.333	25	.933		
	Total	28.000	29			
ADV-H	Between Groups	1.487	4	.372	**.536**	.711
	Within Groups	16.651	24	.694		
	Total	18.138	28			
ADV-I	Between Groups	9.238	4	2.310	**2.144**	.105
	Within Groups	26.929	25	1.077		
	Total	36.167	29			
ADV-J	Between Groups	3.298	4	.824	**.887**	.487
	Within Groups	21.381	23	.930		
	Total	24.679	27			
ADV-K	Between Groups	3.600	4	.900	**1.515**	.230
	Within Groups	14.262	24	.594		
	Total	17.862	28			

Legend			
ADV-A	Constant accessibility	ADV-G	Design assignments to meet student needs
ADV-B	Collaboration in a common experience	ADV-H	Provide higher quality student materials
ADV-C	Increase efficiency and organization	ADV-I	Improve professor-student communication
ADV-D	Increase enthusiasm for teaching	ADV-J	Improve data collection in the field
ADV-E	Increase confidence and computer skill	ADV-K	Improve student learning
ADV-F	Better record keeping		

APPENDIX 7

F table of analysis of variance (ANOVA) of *teaching methods* and respondents' perceptions of *disadvantages* of mobile computing

Significant if the following F score more than $F_{.05}(4,22)$= **2.82**

		Sum of Squares	df	Mean Square	F	Sig.
DISADV-A	Between Groups	3.730	4	.932	**.663**	.624
	Within Groups	30.937	22	1.406		
	Total	34.667	26			
DISADV-B	Between Groups	1.679	4	.420	**.613**	.658
	Within Groups	15.062	22	.685		
	Total	16.741	26			
DISADV-C	Between Groups	1.986	4	.496	**.364**	.832
	Within Groups	30.014	22	1.364		
	Total	32.000	26			
DISADV-D	Between Groups	2.663	4	.666	**.499**	.737
	Within Groups	29.337	22	1.333		
	Total	32.000	26			
DISADV-E	Between Groups	6.500	4	1.625	**1.823**	.159
	Within Groups	20.500	23	.891		
	Total	27.000	27			
DISADV-F	Between Groups	4.732	4	1.183	**1.445**	.253
	Within Groups	18.008	22	.819		
	Total	22.741	26			
DISADV-G	Between Groups	6.475	4	1.619	**2.754**	.054
	Within Groups	12.932	22	.588		
	Total	19.407	26			
DISADV-H	Between Groups	2.915	4	.729	**.595**	.670
	Within Groups	26.937	22	1.224		
	Total	29.852	26			
DISADV-I	Between Groups	6.211	4	1.553	**1.746**	.180
	Within Groups	17.789	20	.889		
	Total	24.000	24			

Legend	
DISADV-A	Lack of time for personal activities
DISADV-B	Feeling lonely and isolated
DISADV-C	Too many e-mails to read
DISADV-D	Need for additional training
DISADV-E	Mobile computing is unreliable/easily break
DISADV-F	Limited battery life
DISADV-G	Too expensive
DISADV-H	Too many accessories needed
DISADV-I	Low quality wireless connection

APPENDIX 8

F table of analysis of variance (ANOVA) of *teaching styles* and respondents' perceptions of *advantages* of mobile computing

Significant if the following F score more than $F_{.05}(4,23)$= **2.80**

		Sum of Squares	df	Mean Square	F	Sig.
ADV-A	Between Groups	9.250	4	2.313	**1.988**	.130
	Within Groups	26.750	23	1.163		
	Total	36.000	27			
ADV-B	Between Groups	5.417	4	1.354	**1.524**	.228
	Within Groups	20.440	23	.88		
	Total	25.857	27			
ADV-C	Between Groups	2.944	4	.736	**1.180**	.347
	Within Groups	13.722	22	.624		
	Total	16.667	26			
ADV-D	Between Groups	4.000	4	1.000	**1.179**	.348
	Within Groups	18.667	22	.848		
	Total	22.667	26			
ADV-E	Between Groups	4.551	4	1.138	**1.419**	.262
	Within Groups	16.833	21	.802		
	Total	21.385	25			
ADV-F	Between Groups	5.534	4	1.384	**1.549**	.223
	Within Groups	19.651	22	.893		
	Total	25.185	26			
ADV-G	Between Groups	4.623	4	1.156	**1.382**	.271
	Within Groups	19.234	23	.836		
	Total	23.857	27			
ADV-H	Between Groups	1.694	4	.424	**.622**	.651
	Within Groups	14.972	22	.681		
	Total	16.667	26			
ADV-I	Between Groups	4.667	4	1.167	**1.030**	.413
	Within Groups	26.048	23	1.133		
	Total	30.714	27			
ADV-J	Between Groups	4.329	4	1.082	**1.193**	.343
	Within Groups	19.056	21	.907		
	Total	23.385	25			
ADV-K	Between Groups	2.269	4	.567	**.801**	.538
	Within Groups	15.583	22	.708		
	Total	17.852	26			

Legend			
ADV-A	Constant accessibility	ADV-G	Design assignments to meet student needs
ADV-B	Collaboration in a common experience	ADV-H	Provide higher quality student materials
ADV-C	Increase efficiency and organization	ADV-I	Improve professor-student communication
ADV-D	Increase enthusiasm for teaching	ADV-J	Improve data collection in the field
ADV-E	Increase confidence and computer skill	ADV-K	Improve student learning
ADV-F	Better record keeping		

APPENDIX 9

F table of analysis of variance (ANOVA) of *teaching styles* and respondents' perceptions of *disadvantages* of mobile computing

Significant if the following F score more than $F_{.05}(4,20)$= **2.87**

		Sum of Squares	df	Mean Square	*F*	Sig.
DISADV-A	Between Groups	2.565	4	.641	**.477**	.752
	Within Groups	26.875	20	1.344		
	Total	29.440	24			
DISADV-B	Between Groups	1.993	4	.498	**.704**	.599
	Within Groups	14.167	20	.708		
	Total	16.160	24			
DISADV-C	Between Groups	6.707	4	1.677	**1.501**	.240
	Within Groups	22.333	20	1.117		
	Total	29.040	24			
DISADV-D	Between Groups	2.607	4	.652	**.525**	.719
	Within Groups	24.833	20	1.242		
	Total	27.440	24			
DISADV-E	Between Groups	2.485	4	.621	**.544**	.705
	Within Groups	23.976	21	1.142		
	Total	26.462	25			
DISADV-F	Between Groups	1.827	4	.457	**.449**	.772
	Within Groups	20.333	20	1.017		
	Total	22.160	24			
DISADV-G	Between Groups	.792	4	.198	**.230**	.918
	Within Groups	17.208	20	.860		
	Total	18.000	24			
DISADV-H	Between Groups	4.507	4	1.127	**.889**	.488
	Within Groups	25.333	20	1.267		
	Total	29.840	24			
DISADV-I	Between Groups	1.433	4	.358	**.300**	.874
	Within Groups	21.524	18	1.196		
	Total	22.957	22			

Legend	
DISADV-A	Lack of time for personal activities
DISADV-B	Feeling lonely and isolated
DISADV-C	Too many e-mails to read
DISADV-D	Need for additional training
DISADV-E	Mobile computing is unreliable/easily break
DISADV-F	Limited battery life
DISADV-G	Too expensive
DISADV-H	Too many accessories needed
DISADV-I	Low quality wireless connection

APPENDIX 10

F table of analysis of variance (ANOVA) of *technology adoption stages* and respondents' perceptions of *advantages* of mobile computing

Significant if the following F score more than $F_{.05}(4,17)$= **2.96**

		Sum of Squares	df	Mean Square	F	Sig.
ADV-A	Between Groups	2.504	4	.626	**.455**	.767
	Within Groups	26.121	19	1.375		
	Total	28.625	23			
ADV-B	Between Groups	6.101	4	1.525	**1.537**	.232
	Within Groups	18.857	19	.992		
	Total	24.958	23			
ADV-C	Between Groups	.658	4	.164	**.242**	.911
	Within Groups	12.212	18	.678		
	Total	12.870	22			
ADV-D	Between Groups	1.902	4	.476	**.607**	.663
	Within Groups	14.098	18	.783		
	Total	16.000	22			
ADV-E	Between Groups	1.030	4	.258	**.328**	.855
	Within Groups	13.333	17	.784		
	Total	14.364	21			
ADV-F	Between Groups	1.449	4	.362	**.353**	.838
	Within Groups	18.464	18	1.026		
	Total	19.913	22			
ADV-G	Between Groups	.637	4	.159	**.227**	.920
	Within Groups	13.321	19	.701		
	Total	13.958	23			
ADV-H	Between Groups	.720	4	.180	**.381**	.819
	Within Groups	8.498	18	.472		
	Total	9.217	22			
ADV-I	Between Groups	3.248	4	.812	**.959**	.452
	Within Groups	16.086	19	.847		
	Total	19.333	23			
ADV-J	Between Groups	4.097	4	1.024	**1.604**	.219
	Within Groups	10.857	17	.639		
	Total	14.955	21			
ADV-K	Between Groups	.894	4	.224	**.414**	.796
	Within Groups	9.714	18	.540		
	Total	10.609	22			

Legend			
ADV-A	Constant accessibility	ADV-G	Design assignments to meet student needs
ADV-B	Collaboration in a common experience	ADV-H	Provide higher quality student materials
ADV-C	Increase efficiency and organization	ADV-I	Improve professor-student communication
ADV-D	Increase enthusiasm for teaching	ADV-J	Improve data collection in the field
ADV-E	Increase confidence and computer skill	ADV-K	Improve student learning
ADV-F	Better record keeping		

APPENDIX 11

F table of analysis of variance (ANOVA) of *technology adoption stages* and respondents' perceptions of *disadvantages* of mobile computing

Significant if the following F score more than $F_{.05}(4,17)$= **2.96**

		Sum of Squares	df	Mean Square	F	Sig.
DISADV-A	Between Groups	1.435	4	.359	**.250**	.906
	Within Groups	24.429	17	1.437		
	Total	25.864	21			
DISADV-B	Between Groups	.657	4	.164	**.218**	.925
	Within Groups	12.798	17	.753		
	Total	13.455	21			
DISADV-C	Between Groups	5.162	4	1.291	**1.001**	.434
	Within Groups	21.929	17	1.290		
	Total	27.091	21			
DISADV-D	Between Groups	5.614	4	1.403	**1.150**	.367
	Within Groups	20.750	17	1.221		
	Total	26.364	21			
DISADV-E	Between Groups	2.530	4	.632	**.513**	.727
	Within Groups	23.429	19	1.233		
	Total	25.958	23			
DISADV-F	Between Groups	.907	4	.227	**.208**	.931
	Within Groups	18.548	17	1.091		
	Total	19.455	21			
DISADV-G	Between Groups	1.864	4	.466	**.566**	.691
	Within Groups	14.000	17	.824		
	Total	15.864	21			
DISADV-H	Between Groups	5.306	4	1.327	**1.002**	.434
	Within Groups	22.512	17	1.324		
	Total	27.818	21			
DISADV-I	Between Groups	1.452	4	.363	**.270**	.893
	Within Groups	21.500	16	1.344		
	Total	22.952	20			

Legend	
DISADV-A	Lack of time for personal activities
DISADV-B	Feeling lonely and isolated
DISADV-C	Too many e-mails to read
DISADV-D	Need for additional training
DISADV-E	Mobile computing is unreliable/easily break
DISADV-F	Limited battery life
DISADV-G	Too expensive
DISADV-H	Too many accessories needed
DISADV-I	Low quality wireless connection

APPENDIX 12

F-table of analysis of variance (ANOVA) of *mobile computer use in the classroom* and respondents' perceptions of *advantages* of mobile computing
Significant if the following F score more than $F.05(4,24)$= **2.78**

		Sum of Squares	df	Mean Square	F	Sig.
ADVA	Between Groups	4.110	4	1.027	.782	.548
	Within Groups	32.857	25	1.314		
	Total	36.967	29			
ADVB	Between Groups	7.149	4	1.787	1.742	.172
	Within Groups	25.651	25	1.026		
	Total	32.800	29			
ADVC	Between Groups	2.690	4	.672	.807	.533
	Within Groups	20.000	24	.833		
	Total	22.690	28			
ADVD	Between Groups	6.217	4	1.554	1.816	.159
	Within Groups	20.542	24	.856		
	Total	26.759	28			
ADVE	Between Groups	2.434	4	.609	.598	.668
	Within Groups	23.423	23	1.018		
	Total	25.857	27			
ADVF	Between Groups	3.765	4	.941	.911	.473
	Within Groups	24.786	24	1.033		
	Total	28.552	28			
ADVG	Between Groups	4.476	4	1.119	1.189	.340
	Within Groups	23.524	25	.941		
	Total	28.000	29			
ADVH	Between Groups	1.638	4	.409	.596	.669
	Within Groups	16.500	24	.688		
	Total	18.138	28			
ADVI	Between Groups	3.000	4	.750	.565	.690
	Within Groups	33.167	25	1.327		
	Total	36.167	29			
ADVJ	Between Groups	1.868	4	.467	.471	.757
	Within Groups	22.811	23	.992		
	Total	24.679	27			
ADVK	Between Groups	3.892	4	.973	1.671	.189
	Within Groups	13.970	24	.582		
	Total	17.862	28			

Legend			
ADV-A	Constant accessibility	ADV-G	Design assignments to meet student needs
ADV-B	Collaboration in a common experience	ADV-H	Provide higher quality student materials
ADV-C	Increase efficiency and organization	ADV-I	Improve professor-student communication
ADV-D	Increase enthusiasm for teaching	ADV-J	Improve data collection in the field
ADV-E	Increase confidence and computer skill	ADV-K	Improve student learning
ADV-F	Better record keeping		

APPENDIX 13

F-table of analysis of variance (ANOVA) *of mobile computer use in the classroom* and respondents' perceptions of *disadvantages* of mobile computing

Significant if the following F score more than $F_{.05}(4,22)$= **2.82**

		Sum of Squares	df	Mean Square	F	Sig.
DISADV-A	Between Groups	7.708	4	1.927	**1.573**	.217
	Within Groups	26.958	22	1.225		
	Total	34.667	26			
DISADV-B	Between Groups	4.782	4	1.196	**2.200**	.102
	Within Groups	11.958	22	.544		
	Total	16.741	26			
DISADV-C	Between Groups	2.500	4	.625	**.466**	.760
	Within Groups	29.500	22	1.341		
	Total	32.000	26			
DISADV-D	Between Groups	6.208	4	1.552	**1.324**	.292
	Within Groups	25.792	22	1.172		
	Total	32.000	26			
DISADV-E	Between Groups	1.361	4	.340	**.305**	.871
	Within Groups	25.639	23	1.115		
	Total	27.000	27			
DISADV-F	Between Groups	1.616	4	.404	**.421**	.792
	Within Groups	21.125	22	.960		
	Total	22.741	26			
DISADV-G	Between Groups	2.241	4	.560	**.718**	.589
	Within Groups	17.167	22	.780		
	Total	19.407	26			
DISADV-H	Between Groups	5.560	4	1.390	**1.259**	.316
	Within Groups	24.292	22	1.104		
	Total	29.852	26			
DISADV-I	Between Groups	1.424	4	.356	**.315**	.864
	Within Groups	22.576	20	1.129		
	Total	24.000	24			

Legend	
DISADV-A	Lack of time for personal activities
DISADV-B	Feeling lonely and isolated
DISADV-C	Too many e-mails to read
DISADV-D	Need for additional training
DISADV-E	Mobile computing is unreliable/easily break
DISADV-F	Limited battery life
DISADV-G	Too expensive
DISADV-H	Too many accessories needed
DISADV-I	Low quality wireless connection

Appendix 14

Five professors' statements and the seven principles of Post-modernism professionalism

Principle 1: Increased opportunity and responsibility to exercise discretionary judgment over the issues of teaching, curriculum and care that affect one's students

Professor A reported that students must have an opportunity to express their opinion about the class schedule and the sequence of lab time and laptop session in a week. The professor then used students' feedback to adjust the schedule and sometimes syllabus to satisfy the students. "They kind of like that idea, having the regular lab, [and] the laptop, so they only have to bring their laptops once [for every week]. And then there is the two hour discussion class in an old fashion way, so they kind of like that more." (Personal communication, September 18, 2003).

Professor B reported that every student the the professor's course could make suggestions on how the class project be done. If the student has a problem, the professor was willing to listen and to help the student solve the problem so the project can be done according to the professor's standards. "If they give me a project that came back, I would say 'this is what you need to make, to do better to get a better grade. You have another week to rewrite this'" (Personal communication, December 2, 2003).

Professor C reported that the students could understand a concept from both lectures and class projects. However, the professor believed that the students could learn more from projects because they had problems along the

process and came back and forth to the professor to solve those problems. "I make sure my projects get them involved with the materials that I want them to learn" (Personal communication, September 11, 2003).

Professor D reported that students must not hesitate to communicate with other students and the professor if they have problem in the class. The professor also suggested students to check discussion board on the course web site frequently so they will not left behind in the course. "So, if they need any help, they will e-mail me, and then I will e-mail them back. We also use the discussion board for each group" (Personal communication, September 29, 2003).

Professor E reported that students should look beyond symbols and numbers when they are working with computer software and spreadsheet. The computer can make life easier, but the students must look the outcome of computer calculation very carefully. In the professor's field of expertise, changing a figure could change the whole institution, and sometimes about someone's life and death. "Use software but always make sense of the numbers, OK?;" "When you get done, look over it and thoroughly;" "Make sense of your data" (Observed class meeting 3; November 20, 2003).

Principle 2: Opportunities and expectations to engage with the moral and social purposes and value of what teachers teach, along with major curriculum and assessment matters in which these purposes are embedded

Professor A reported that students must behave like mature adults by knowing their rights and responsibilities. The professor believed that students were the future of our society, so they must learn to be discipline and work

professionally in the class. "I ask them to bring their laptops so they can work with the spreadsheet. If I ask them to bring the laptops, they should bring it. I don't want to treat them like a child. They are adult" (Observed class meeting 2; October 22, 2003).

Professor B reported that students must conserve the nature and concern with the state of their environment. So, professor B was reluctant to make paper handout. Instead, the professor asked students to download the course materials from the course web site. Prof. B tried to stop wasting papers. However, when professor B must distribute paper handout, the professor made some comments: "I kill more trees here;" "No one gets extra copies today" (Observed class meeting 3; December 9, 2003).

Professor C reported that the students should be ready to experience diversity in their workplace in the future. Therefore, they must respect people who are different from their own ethnicity or race. "My students going out now expect diversity in the workplace. They see far more diversity in workplace than my generation when they were in the workplace. They don't even think twice about things that we struggle with. They just accept it and get along with it" (Personal communication, December 4, 2003).

Professor D reported that students could learn from other countries in the world about politics and geography. The professor often asked students about the difference between the United States and other countries in the world in certain aspects. The professor also explained about news, such as terrorism,

bombings, and poverty. "What's holding people together? Government, democracy, freedom, free economy" (observation 1). "There is an idea to promote eco-tourism to curb the negative effects of tourism. How to [make] safe the environment and give benefit to the indigenous people" (Observed class meeting 3; December 2, 2003).

Professor E reported that in the professor's field and also in the course, students were required to be helpful and caring to others, especially those who seek their service. The professor's role in this course is to make the students complement those virtue with critical thinking ability. "[In this field], helping each other is a big thing, but [what also important is] critical thinking works for the student. Right there, [the student] helps other students who have problems with spreadsheet exercise or printing out the results [through a wireless network]." (Personal communication, November 30, 2003).

Principle 3: Commitment to working with colleagues in collaborative cultures of help and support as a way of using shared expertise to solve the ongoing problems of professional practice, rather than engaging in joint work as a motivational device to implement the external mandates of others

Professor A reported that new knowledge emerges every moment and nothing is stay the same all the time. Professor A perceived membership or involvement in professional and academic organizations would give the professor an edge in keeping up with new developments in the field. "All of the associations have their own journals, continuing education programs, workshops, conferences, etc. The conferences and workshops provide the opportunities for

academics and accountants to get together to exchange ideas. The associations provide me the opportunities to write articles and present workshops" (Personal communication; February 3, 2004).

Professor B reported that co-teaching was wonderful experience and the professor enjoyed it very much because it could help the professor to learn from other professor in the same field. The most important experience in co-teaching was they can solve problems together, especially when they must work with new technology such as e-mail and course web site. "I am co-teaching with another professor,...when we work through Blackboard.com, [the professor's e-mails] just won't hit through [to the students' e-mail addresses]. You know there are always some difficulties that we need to keep an eye on" (Personal communication; September 30, 2003).

Professor C reported that students must be able to work in groups to make learning more meaningful and at the same time learn how to improve their teamwork skills. Collaboration with students from other countries, such as China, could help them to learn about the world. "The group that I am working with in the collaborative distance learning honors course all have that goal. Bringing together distance people, students, working on global issue, is our goal" (Personal communication; September 11, 2003).

Professor D reported that the professor was a member of two academic and professional associations. Professor D perceived this activity has helped the professor to learn new developments and other experts in the field. More

importantly, the professor stated that students could get the benefit from these academic activities. "[In the professional and academic associations, I] go and present paper and then attend other presentations and talk, meet professionals from other states, from other schools, and exchange ideas" (Personal communication; September 29, 2003).

Professor E reported that professors should be able to teach using computer technology because they could make teaching and learning more interesting and efficient. The professor expected that every professor in the department could make Power Point presentation for his or her class for a starter. "I don't think they expect 100% of the faculty to do it [Power Point presentation for the class]. I think that will be amazing. But we are getting there. My goal is by next stop [year] to have every course be on-line [for web-enhance courses], on Blackboard.com, and use Power Point as a minimum" (Personal communication; September 25, 2003).

Principle 4: Occupational heteronomy rather than self-protective autonomy, where teachers work authoritatively yet openly and collaboratively with other partners in the wider community, especially parents and students themselves, who have a significant stake in the students' learning

Professor A reported that the students could also teach professor some new tricks in using computer. So, the flow of new knowledge was not always from professor to students. By giving students an opportunity to explain their knowledge about computer, they will be pride and more confidence in using technology in the classroom. "Faculty and students can share experiences in

using the technology. Faculty can learn from students' use of the technology -- learning is easier." (Response on survey in phase one of the study).

Professor B reported that sometimes students come to the professor and share their personal problems. The professor usually help the students, especially if the problem influencing the students' academic performance. Professor B would also guide the students to the right staff in campus or outside of campus. "You know that it can be very discouraging and depressing to know what's going on in some of the students life. But I know that...I am sure that I help some students" (Personal communication; December 2, 2003).

Professor C reported that the students inspired the professor to collaborate with other experts outside of the campus. The professor usually introduces colleagues or friends to students and allow them to discuss certain topics with the outside sources. "I would like to see wireless actually allow the students to be able to converse with those students around the globe while in the classroom. Or at least to be able to post on the bulletin boards and use feedback collaborative classrooms around the globe" (Personal communication; December 4, 2003).

Professor D reported that the professor was open to students' suggestions or objections about certain issues in the course. "I think because we learn from each other, even the professor can learn from the students, and the students learn from each other" (Personal communication; September 29, 2003).

Professor E reported that the college administration encouraged professors in the department to use technology for teaching and learning. This encouragement has helped the department to achieve high academic standards, which was shown by its national rank in the field. "Support by the college meaning that the college is very supportive of this department. And that shows in budget, it shows in what they say about us, alumni, current students, you know the entire college community is very supportive of this program" (Personal communication; November 30, 2003).

Principle 5: A commitment to active care and not just routine service for students. Professionalism must in this sense acknowledge and embrace the emotional as well as the cognitive dimensions of teaching, and also recognize the skills and dispositions that are essential to committed and effective caring

Professor A reported that students might ask the professor's assistance at anytime, especially if they have problems with the class assignments or projects. Although, it would be up to the students to make the call because the professor would like to see the students growing up and learn to solve the problems by themselves. "I came with a virtue that they are having a problem [and will solve it], but it's still up to them to what they are going to do. They can e-mail me. They can make appointments. But still it's up to them to make that decision" (Personal communication; September 18, 2003).

Professor B reported that students should learn new things outside of the field, such as public speaking and relaxation techniques, so they become well-rounded individuals. In one occasion, Professor B taught meditation in the

classroom: "Turn off the light;" "Everybody close eyes;" "Take deep breath;" "Whole body stay relax;" "Tighten your feet and then release;" "tighten your hands and release" (Observed class meeting 2; October 22, 2003).

Professor C reported that students could learn that technology is not always working as they expected. The students must have experience in dealing with problems in technology and learn to solve the problems profesionally. "Technology environment is frustrating. They have to learn to deal with that frustration. So, I want my students to deal with that frustration" (Personal communication; September 11, 2003).

Professor D reported the professor gave students opportunities to discuss problems they have in the class assignments. The professor also taught students in how to make Power Point presentation, to scan graphs, to download applications from the Internet, and to use new software that sometimes were not directly related to the course but would improve the quality of students' works. "Sometimes some students have problems [and] I try to help them; to see any way I can help them to learn" (Personal communication; December 5, 2003).

Professor E reported that the professor allowed the students to share their problems. The professor then made all the efforts to solve the problems. "They can e-mail me. Usually it is an immediate kind of thing" (Personal communication; September 25, 2003). "I want to make sure everybody understands;" "I am here to help" (Observed class meeting 3; November 20, 2003).

Principle 6: A self-directed search and struggle for continuous learning related to one's own expertise and standards of practice, rather than compliance with the enervating obligations of endless change demanded by others or often under the guise of continuous learning or improvement

Professor A reported that the professor would like to learn new technology through its application in the classroom context. The professor would like to make an experiment with the new technology by trying it, and learn from the experience before really using it for teaching. "I want to see what the feature is, and see if this apply. I would probably see what kind of a feature, what new tool that they bring you up to see whether or not it will be applicable for something that I might be able to do. So I do it the other way and look myself" (Personal communication; September 18, 2003).

Professor B reported that on-campus Information Technology training was very useful to learn new technology, especially wireless network and laptop. The professor always signed up if the office of Information Technology offers new trainings. "I have gone [to] just about every one of them [trainings conducted by the Office of Information Technology]." Prof. B (Personal communication; September 30, 2003).

Professor C reported that the students could use wireless network and laptop in earlier year, such as freshman, so they have more time to use it while they are in the college. In addition, the students could work innovatively and creatively with their laptops without worrying that they might lose valuable company data or crash the whole company system. "I am hoping for new ideas

to come up out of this by our using it earlier on than [the students graduated and use it in] the work setting. Because by [using wireless network and laptop in] the work setting, you are going to, you lose any of that, a lot of that innovativeness" (Personal communication; December 4, 2003).

Professor D reported that the professor always visits academic web sites, attend Information Technology trainings, discuss new technology with experts inside and outside of the college, and frequently check updates of software the professor used. "So we take the Blackboard...and every time they have updates, they have a new tool, they have anything, I just go on-line, it's called 'Teaching on the Web'. So you go to the site and take the update; they make you update for a new technology" (Personal communication; September 29, 2003).

Professor E reported that the professor always brings the laptops wherever the professor goes to learn new developments in the field, even if the professor is on vacation. Professor E also agreed that the college has been very helpful in assisting professors who want to apply technology in their courses. "I took it [wireless laptop computer] on my vacation because I have to learn the course;" "I think the campus has done a really good job in educating the faculty on the uses and support [and that] kind of thing" (Personal communication; September 25, 2003).

Principle 7: The creation and recognition of high task complexity, with levels of status and reward appropriate to such complexity

Professor A reported that sometimes the professor made complex class assignments to see if students could work on them properly. "This is a chaotic

class, let's see what happens" (Observed class meeting 1; September 29, 2003). Prof A used 'chaotic' term for many tasks that the class must accomplish on that day. Yet, the professor can understand if students get lost and therefore the professor must help students individually or collectively in comprehending the course materials

Professor B reported that the students could learn from the professor's experience. Real life events in the field were not in the textbooks or lectures, so the professor expected the students to be able to apply the basic knowledge from the classroom to the real life situation. Laptop computer helped the professor to structure those experience according to the sessions of the course. "I tend to teach and bring a lot of different examples and ideas from experience. And I sometimes get off track, but having the computer and knowing that this is what I am gonna have to start with and this is what I am gonna do next" (Personal communication; December 2, 2003).

Professor C reported that the students would understand the concepts in the course through group works in the classroom. The professor usually divided the class in several groups and gave a task to each group. For example, each student assigned a number and based on that number, he or she in that group number. "Group one there, two here…;" "When you finish reading you should connect the models with your exercise in your group" (Observed class meeting 2; October 23, 2003).

Professor D reported that students must comprehend the different assignments in doing research, writing reports, presenting research findings, and working in groups. "So in education it is very important for them to learn how to do research, how to work together as a group, how to present their ideas to other people" (Personal communication; September 29, 2003).

Professor E reported that the students who completed the course and program in the professor's department were satisfied with the course works that sometimes required them to use laptop. "I think that they are more involved in what they tell us in evaluation process that they are more involved with decisions regarding computer and computer use in general in their agencies [organizations that the alumni now working with]" (Personal communication; November 30, 2003).

Appendix 15

Five professors' statement regarding distraction due to mobile computing in their classroom

Professor A said that:

> "[Students] do multitasking. They [also] will do this type of thing [instant messaging or e-mailing while listening to a lecture or working on exercises] because it is pretty much more relaxing and it's a little different like get up [from boring lectures] and tell them something exciting, but they pretty much will do what they are asked to do. I haven't had that much of a problem."

Professor B said that:

> "Ohh...if I find them doing it I say 'close it'. No big deal. But you know I have also noticed that this particular type of students are also want to multitask. They can hear you. They can listen. They can take notes. And they can do their e-mailing. It doesn't bother me. It is like someone falling asleep in class. If someone falling asleep in class, I don't care."

On the other hand, professor C, D, and E did not tolerate activities other than the ones that the professors asked the students to do in the classroom. Professor C did not explain his/her distraction policy, but in the classroom observation, the professor paid close attention on the students' activities and immediately reminded those who did not pay attention to the lecture, presentation, and exercises.

Professor D said that:

> "Sometimes the students, they come to the class, they come with their laptops and instead of paying attention, or doing what you want them to do, they just go on-line and go to some web sites, sometimes go to the chat room and chatting with some people, and sometimes they go and get...So you have to be a little bit careful with that. Sometimes I tell the students 'don't bring your laptop to the classroom until I tell you to'. I don't tell you, you don't bring it."

Professor E said that:

> "I am usually in here working, and one of the students was IM-ing [instant messaging]...so I told them to stop. So yes, I think they do. They probably search the web while the class is going on. They maybe writing their homeworks, I don't know, but usually, especially in this department when we pull out the computers, it's an organized activity, so it's not that they have them in front of them just for taking notes or whatever. We pull out the laptops for a particular lab activity. They have to go to certain web sites. I think that decreases that kind of searching."

Professor C, D, and E who implemented zero tolerance policy on distracting activities had different strategy to limit the distraction. Professor C would approach the students who did e-mails or instant messages, and asked

them to turn-off the computers. Professor D would tell the students when to bring laptop computers. If the class that day did not need laptop computers, then professor D would asked students to put the laptop computers in their bags. Almost similar to professor D, professor E assigned certain days for laptop computer activities, but professor E would create many assignments on the computer days so the students would not have time to do something else.

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PUBLICATIONS

Soefijanto, Totok. 2004. *Money is Not the Solution of Problems in Education.* Jawa Pos daily newspaper, **August 12, 2004**. Available on-line at http://www.preventconflict.org/portal/main/issuedetail.php?a=10568

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PAPERS PRESENTED

November 17, 2004. "*Promoting Education in Indonesia.*" Organizer: Yale Indonesia Forum at Yale University. Place:Weir Seminar room, Jonathan Edwards Residential College, 68 High Street, New Haven, CT. The abstract is available on http://www.yale.edu/seas//SoefT.htm or the full paper is available on-line at http://www.preventconflict.org/portal/main/TotokYIF04.pdf

June 28, 2003. *"A Review of the New National Education System Bill: Should or Shouldn't it be Passed?"* Organizer: Global Player (Association of Indonesian Students in the Northeastern area). Place: Indonesian Consulate General ballroom, New York.

February 24, 2003. *"Observing Indonesia through Its Conventional Wisdom."* Organizer: Harvard Program on Humanitarian Policy and Conflict Research. Place: 1033 Massachusetts Avenue, fourth floor, Cambridge, MA 02138. The paper is available on-line at http://www.preventconflict.org/portal/main/cw.pdf

August 24, 2002. "*Emphasizing Dewey's Constructivism in Higher Education: A Design for Investigative Reporting Course*". Organizer: Permias Mass Grad (Association of Indonesian Graduate Students in the US). Place: Campion Hall, Lynch School of Education, Boston College. In conjunction with the celebration of the 57-th Indonesia's Proclamation/Independence Day. The invitation is available on-line at http://www.mail-archive.com/permias@listserv.syr.edu/msg13019.html

INTERVIEWS

August 23, 2004. A one-hour TV interview with Voice of America/J-TV (Surabaya) about "*Indonesian Second Generation in the US"* for Indonesian viewers. The program web site is available on http://www.jtvrek.com/salamvoa.php

June 16, 2004. A two-page interview with Warta Ekonomi magazine about "*Department of National Education should not Implement A Uniform Policy"*. It is available in English version at http://www.preventconflict.org/portal/main/wartek16JUNi04.html

March 4, 2003. A one-hour TV interview with Voice of America/Indosiar about "*War in Iraq: Is it a Clash of Civilizations?"* for Indonesian viewers. The summary of this interview is available on-line at http://www.indosiar.com/v2/news/news_read.htm?id=6928

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