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EXAMINING COLLEGE OF EDUCATION STUDENTS' EXPERIENCE AND

PERSPECTIVES ON LAPTOP USE IN TEACHING AND LEARNING: A MIXED-

METHOD STUDY

A Thesis in

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by

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ABSTRACT

This study adopts an epistemological basis from phenomenology, takes constructivism as a philosophical framework, and aims at exploring and describing College of Education students' experience and perspectives of using laptops in learning and teaching. Using an online survey, this study gathered both qualitative and quantitative data from 145 students from the College of Education at Penn State University during the 2009 and 2010 academic year, two year after a 1:1 laptop initiative, regarding various aspects of laptop use. Both quantitative and qualitative methods were applied in data analysis. Findings show that students consider laptop use changes the dynamic between instructors and students. The positive influence of laptop use includes enhanced communication and providing medium for presenting materials; the negative impact is distraction. Students believe that laptop use increases engagement and facilitates knowledge-transfer. Students see themselves more effective in utilizing technology for instruction and believe technology can impact teaching in a positive way. Students consider the use of video is important to the preparation to become teachers and the use of internet promotes active class participation and empowers them as learners.

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Chapter 1

Introduction

One-to-One (1:1) computing as a trend in education

During the two decades after the mid-1990s, 1:1 computing and the concept of "ubiquitous computing" had become a noticeable, widely spread trend in both K-12 and higher education settings in the USA and other countries.

In the United States around 1988, Mark Weiser and John Seely Brown of Xerox Palo Alto Research Center (PARC) wrote the earliest papers on "ubiquitous computing". Weiser's concept of "ubiquitous computing" was influenced by fields outside computer science including phenomenology, psychology, and sociology of science. MIT also contributed significant research in this field through the Things That Think consortium at the Media Lab. Other major contributors included Georgia Tech, NYU, UC Irvine, Microsoft Research, and Intel Research. Microsoft launched the Anytime Anywhere Learning program in the mid-1990s (Johnstone, 2003) and since then, schools including both higher education and K-12 started to incorporate 1:1 computer programs into classrooms. In 2001 Apple announced a state-wide 1:1 laptop program in Maine and the following year pushed through the program to provide iBooks for more schools across the country.

In K-12 settings, during 2003–2004, it was estimated that 4% of the nation's school districts were implementing 1:1 computing (Bebell, 2010). A report from the National Center for Education Statistics (NCES) indicated that 10% of the public schools

lent laptop computers to students in 2005 and another 3% of the schools planned to have laptop computers available to loan to students (Wells & Lewis, 2006). In 2006, it was estimated that close to 25% of school districts were implementing some form of a 1:1 laptop program (eSchool News, 2006). Forecasts of trends in educational technology suggested that the number of such implementations was increasing rapidly in K-12 in 2008 (Center for Digital Education, 2008). 1:1 Programs currently exist across the nation in South Dakota, Pennsylvania, New Hampshire, Texas, Georgia, Louisiana, California, Virginia, Florida, Kansas, Maine, Massachusetts, and Michigan.

In higher education settings, from 2002 to 2005, many universities in the USA launched and researched 1:1 programs. These included North Carolina State University (Spurlin, 2002), University of Texas- Austin, a noteworthy leader in the field, University of South Florida (Green, 2003), United States Military Academy at West Point (Efaw, Hampton, Marinez, & Smith, 2004), UCLA, Carnegie Mellon, Georgetown, University of Miami, University of Virginia, and Indiana State University. Overall 1:1 computing is indisputably the current trend in higher education.

As a global trend, laptop initiatives had been started and became a trend in middle and high schools in many countries such as Australia, Canada, France, and New Zealand (Newhouse & Rennie, 2001), Spain, Northern Ireland, Germany and Israel (Livingston, 2007). In higher education settings, by April 2002, approximately 140 higher education institutions in the US, Canada, Japan, Amsterdam, the UK and Australia had on campus programs using laptop or notebook computers (Brown, 2002). 1:1 programs were

launched and researched in many countries, for example, colleges and universities in Finland (Eriksson, 2009), Israel (Klieger, 2009), and Sweden (Lindroth, 2010),

To conclude, 1:1 programs have become a trend in both K-12 and higher education settings across both USA and other countries; preparing future teachers that provide high-quality instruction in this environment is an important task of Schools and Colleges of Education.

EDUCATE- 1:1 initiative at Penn State

Penn State University (PSU) and State College Area School District built a collaborative teacher education partnership - The Elementary Professional Development School (PDS). Interns in the PDS were undergraduate elementary education majors at PSU who completed a one-year internship in schools during senior years. During the 2005-2006 internship year, all PDS interns and instructors were facilitated with Apple iBooks and this was the initiative stage of EDUCATE.

EDUCATE aims to make use of digital tools to support teacher education. Technology was embedded in and supporting core elements of the preparation of beginning elementary teachers. Technology trainings were provided to faculty and students prior to EDUCATE, and the emphasis was placed on how in-class interactions could be transformed.

The pilot stage of EDUCATE represented a significant development in utilizing technology to improve teaching and learning. When technologies are properly utilized, technology integration could become a way to transform teaching and student learning. In

the fall of 2008, a decision was made to require all incoming elementary education students to bring notebook computers to class.

Statement of the problem

As 1:1 computing became more widely used in classrooms, it attracted increasing attention from political leaders, educational administrators and practitioners, and educational researchers. Educational and political leaders looked for evidence that providing students access to powerful computing technologies may significantly contribute to long-term economic prosperity (Hayes, 2006). Researchers also tried to address issues that potential attractiveness of 1:1 programs must be weighed against their considerable cost (Hu, 2007).

Early studies focused more on evaluation and assessment of 1:1 computer programs. Some studies (Bebell, 2005; Penuel, 2006; Tinker, Galvis, & Zucker, 2007; Hill et al., 2000) examined the positive and negative outcomes. The relationship between student achievement and participation in 1:1 programs (Gulek and Demirtas, 2005) was also a frequently discussed issue. A large number of articles evaluated the initial phase and problems in implementation (Cuban, 1986: Cuban, 2001a; Zhao et al., 2002).

Despite the above growing interest in and discussion on 1:1 computing, there has been a lack of studies providing deeper exploration of the impact of 1:1 computing on students' learning as well as the changes and possible transformation a laptop brings about in teaching and learning. Also there has been a lack of study offering more detailed and rich description about students' thinking and perspectives on laptops in teaching and learning, especially the situations and perspectives of the group of students in Schools

and Colleges of Education. Exploration and description of the experience and perspectives of this group of students have social significance, as this group of students will become future teachers of the next digital generations who use Internet, computers, and mobile technologies as integrated parts of life. Teachers of these generations are expected to efficiently and effectively utilize various continually newly emerged technologies to process information and provide instruction in the formal educational environment using traditional pedagogies. This could be very challenging.

This study is an effort to understand more about the experiences of students in the College of Education, i.e., future teachers, about laptop use in teaching and learning and the meaning they ascribe to these experiences, to provide description and fill the void in existing literature and offer ideas that help current educational practice.

Purpose of study and research questions

The purpose of this study is to describe the experiences, behaviors, and shared culture of undergraduate students in the College of Education in 1:1 computing teaching and learning environments. The research question is: What is the effect of MacBook use on College of Education students' learning? This question will be answered by two sub-questions: (I) Does MacBook use change students' perspectives on teaching and learning and how? (II) How do students use the MacBook as a tool for teaching and learning?

Theoretical framework

Constructivism, "a theory of knowledge with roots in philosophy, psychology, and cybernetics" (von Glasersfeld, 1995, p. 162) is the base of contemporary innovative learning environments. According to Constructivists, the center of the educational

process is construction of knowledge in the learner's mind. In constructivism learning environments, learners are encouraged to create their own mental framework and formulate their own conceptual models. Constructivism promotes the experience of hands-on problem solving and active learning (Bruner, 1990). Literature on technology enhanced constructivism teaching and learning mainly offered perspectives on the issues below.

- *Self- regulation-* Learners take responsibility through setting goals. During the learning process, learners are aware of their actions and manage factors that affect the process of achieving goals. In technology integrated learning, self regulation also includes learners' creation of a suitable learning environment (Zimmerman, 1989).

- *Student engagement-* Student engagement represented by student on-task behaviors, which include actively seeking assistance relative to the task and persisting with the task by completing assigned learning activities (Doyle, 1986).

- *Flexible learning-* Flexible learning means the possibility of choosing study modes and the opportunity to access learning materials and the instructor (Honey, 2004).

- *Interactivity-* A process that a learner actively adapts to information being presented by a form of technology. Interactivity in learning involves real-time dynamics and mutual give-and-take between an instructional system and a learner (Weller, 1988).

- *Collaborative learning-* When the interaction between the learner and peers is technology-facilitated, collaborative learning is enhanced. Successful interaction depends upon how comfortable a learner feels working with the delivery medium, through which a learner can interact with content, the instructor, and other learners.

In brief, laptops together with networks increase the availability of learning materials and information sources, and thus make a significant difference in study habits. Laptops are also valuable studying tools that help students with classroom assignments, communication, and research (Demb, Erickson & Hawkins-Wilding, 2004). Because they enhance hands-on, exploratory learning (Barak, Lipson and Lerman, 2006) and offer flexibility regarding when and where to study, laptops afford the potential for self regulation and increase learners' motivation (Zimmerman, 1998). All of the above advantages represent a remarkable technology infusion and new interaction type that facilitate teaching-learning, particularly in a "ubiquitous" computing environment. Laptops can be personal and portable, and the physical environments create a context for the interaction between users, applications, and the surrounding environment (Dey & Abowd, 2000).

Research tradition

This study is rooted in the philosophies of phenomenology combined with case study. Case study, as a qualitative approach, explores a case over time through detailed, in-depth data collection involving multiple sources. In our case, the case being studied

includes programs, activities, and group and individual students. The context of the case involves the physical setting and the social, historical, and economic setting for the case will also be discussed. Phenomenological studies seek to explore the experiences of individuals who have encountered a phenomenon. In our study, we search for the essence of students' learning experiences in a 1:1 computer environment and emphasize what an experience means for them and to provide a comprehensive description of it. We also want to understand the students, who will be future teachers in 1:1 environment, as a group, and the group's patterns of behavior, customs, and ways of learning with 1:1 computer. Finally, we want to understand the meanings of behavior, language, and interactions of the culture-sharing in the teaching-learning environment with 1:1 computer.

Why is my study phenomenology?

Creswell (1998, 2007) suggested that there were five types of qualitative approaches such as autobiography, grounded theory, phenomenology, case study, and ethnography. I would like here to define that the epistemological basis of my study is mainly borrowed from phenomenology, which focuses on "experience" and "interpretation" (Merriam, 1998) and is "the first method" of constructing knowledge because it "begins with things themselves" (Moustakas, 1994).

First, this study was designed to examine pre-service teachers' laptop use within a "real" environment and use data draw from participants' firsthand experience. Just like Stake declared, "Qualitative case study was developed to study the experience of real cases operating in real situations" (p. 3). In the same vein, Van Manen (1990) stated that

in phenomenological researches, participants were co-constructors of the descriptions and interpretations of the study.

Second, this study aims to understand the meaning that pre-service teachers attribute to their laptop use experience. According to Van Manen (1990) and Moustakas (1994), phenomenology seeks to understand the nature of a phenomenon and to reveal the essence of human experience; for Creswell (1998, 2007), Phenomenology depicts "structures of consciousness" and the meaning of lived human experiences regarding a concept or the phenomenon.

Furthermore, as a tradition in qualitative study in education, the phenomenology approach is widely used in current research, often combined with other research methods, to explore teachers' and learners' lived experience with technology in learning. Adopting a story-telling narrative style, Wilson (2008) explored and depicted seven teachers' experience of methodological use of "elicitation" with new technology during professional development and particularly, described teachers' thinking and the meaning they attributed to their actions and concluded that "elicitation" could help disclose the tensions between commitment and resistance that teachers may experience in incorporating new technologies into their practice. Drawing on theories and perspectives of cognitive neuroscience, media psychology, and phenomenology, Mangen (2010) conducted a study through multidisciplinary "piecemeal theorizing", theoretically and methodologically reflected on research of information technology in early childhood education, and discussed the implications of "intangibility" of digital technology on children's literacy development.

Other phenomenology studies of technology in learning include: Leftwich's (2010) hermeneutical phenomenology study that investigated the value beliefs that underlie teachers' uses of technology; Asunda (2007) used a phenomenological approach and sought to find out the critical features of engineering design in technology education; Yeh's (2007) phenomenological study to understand students' perceptions of using online discussion as a learning tool; Ford's (2008) phenomenological study conducted with a group of doctoral students preparing to be technology leaders to gain insights regarding the effectiveness of existing technologies in facilitating a virtual professional learning community; Grushka's (2009) critical phenomenological study that used longitudinal and case-study method to explore insights about student learning in a post-compulsory visual art curriculum in New South Wales, Australia.

By probing into students' experiences in learning in 1:1 laptop environments, the effort is not only made to understand the students' perspectives of their experiences, but also to help inform the practices of instructors and designers to better integrate this technology into teaching and instruction. In brief, in this effort to explore the lived experiences of how do students use laptops and how they feel about the laptops in their learning, a combination of the tradition of case study and phenomenology inquiry best address the needs of the study.

Philosophical framework

From the views of constructivism, the center of the educational process is construction of knowledge in the learner's mind. In constructivism learning

environments, learners are encouraged to create their own mental framework and formulate their own conceptual models. Constructivism promotes the experience of hands-on problem solving, and active learning (Bruner, 1990). These lead to the philosophical assumptions of this inquiry – constructivism is the base of contemporary innovative learning environments.

In conclusion, the philosophy of a combination of case study and phenomenology permitted the culture, behaviors, and experience of the participants to be explored in a way that depicted the interactions in 1:1 computer environments. Further, the theory of constructivism and learning technology provide a base for exploring the nature of learning in 1:1 computer context.

Following this chapter, a review of literature is presented. The literature review contains literature on constructivism and learning technology as well as a collection of research focus on 1:1 computer. Chapter 3 offers a description of the research procedures. Chapter 4 merges the findings with the discussion. Chapter 5 includes implications of this study, researcher reflections, and extensions to this study.

Chapter 2

Literature Review

Part I. Theoretical Framework

Constructivist learning environment

Contemporary innovative learning environments base their theoretical framework on constructivism, which is a "theory of knowledge with roots in philosophy, psychology, and cybernetics" (von Glasersfeld, 1995, p. 162).

Constructivism puts the construction of knowledge in the learner's mind as the center of the educational process. It emphasizes learners' responsibility of organizing their own learning, calls for diverse learning styles and strategies (Keyser, 2000; Niemi, 2002; Johnson, Johnson, & Smith, 1998). Learners are encouraged to create their own conceptual framework and models.

Constructivism calls for the implementation of hands-on problem solving and the promotion of active learning" (Bruner, 1990). In constructivism learning environments, students do not listen to lectures passively; rather, they are actively engaged in developing cognitive skills and transmit information (Keyser, 2000). Students actively discuss ideas, solving problems, and provide feedback through peer-learning and higher-order thinking (Johnson, Johnson, & Smith, 1998; Towns & Grant, 1997).

Ubiquitous computing adds constructivist feature

Mobile and wireless technology has been developing rapidly and brings about new learning environment. A ubiquitous computing environment is Internet-ready, equipped with various devices and software. In ubiquitous computing environment, learning activities are no longer constrained by fix desktops; rather, they interact with a portable device, allow users to navigate the internet and communicate with others. The classroom is transformed to an environment embedded with diverse devices and interfaces that creates new possibilities for interactivity among learners and teachers and computers.

In 1:1 computing learning environments, teacher action becomes more constructivist in nature (e.g., Lowther et al., 2003; Russell, Bebell, Cowan, & Corbelli, 2002). A Constructivist perspective is a key factor in successful 1:1 computing learning environment (e.g., Ward, Keller, & Figg, 2003; Windschitl & Sahl, 2002).

Student-centered learning

Researchers found that teachers in 1:1 computing classrooms created student-centered instruction (Mouza, 2008) and provided students with opportunities to engage in higher order thinking (Barron et al., 2006). With access to contemporary technologies, learning environment changes from a traditional teacher-centered one to a student-centered one. Students perceived wireless laptops enhanced student centered, hands on, and exploratory learning (Barak, Lipson and Lerman, 2006).

Interactivity

Ubiquitous computing learning environments re-shape students' learning style and interactive types. In computer-assisted instruction, the quality of interaction determine the quality of instructional practice and individual learning (Draves, 2000).

Flexibility and self-regulation

Today's youth are the digital generation who are comfortable with using technology and the Internet as an integral part of life. Teachers of this generation are often expected to process information in the formal educational environment using traditional pedagogies.

Wireless laptops provide a wide range of tools and allow users to connect to World Wide Web at anytime and anywhere. They increase the chance of obtaining information and communicating with others. They also provide space for users to store and share their products of different forms, for example, text, audio and video files and blogs. Through the above functions, laptops increase flexibility and effectiveness of learning.

Wireless laptops enable students to use different skills and strategies to complete learning tasks outside of classroom. The definitions of flexible learning (Honey, 2004) usually include the possibility of choosing study modes and the opportunity to access learning resources. Wireless laptops offer flexibility to learners to choose the time and place to study. This flexibility allows learners to take charge of one's own learning by

controlling the environmental factors, and thus facilitates self-regulation and increases motivation.

Self regulation in education is understood as taking responsibility in learning through setting goals and an awareness of one's own actions and factors that affect learning process. It involves the choosing and creating a suitable learning environment. With a higher intrinsic motivation, learners effectively use available tools and interact with learning environments, and have better opportunity of self regulation.

Transforming learning

Wireless laptops have been becoming an integral component of teaching and learning. They change class communication, the way information flows, and classroom settings and activities. The use of wireless laptops is changing the learning environment and in turn, changes the definition of a class (Chan, Hue, Chou, & Tzeng, 2001). In schools, laptops make materials and information available to students, increase the chances of communication and feedback, and offer students valuable studying tools. Laptops and network change the way that students complete assignments and projects, conduct research and communicate with others, and thus make significant difference in students' learning habits, academic and social lives.

Part II. Research on 1:1 computing

A big portion of previous literature focused on barriers and problems in implementing 1:1 laptop programs. Previous research offers factors affecting laptop integration including professional development, availability of resources and technical

support, teacher readiness to integrate technology, and teacher beliefs and attitudes (Murphy et al., 2007; Penuel, 2006). The biggest challenge is that students, faculty, and administrators need to know when and how to use the laptop in the classroom while simultaneously reducing the negative impacts of inappropriate use (Elliott and Hall, 2002).

Implementation: administrative support, teacher attitude, and technical training

O'Dwyer (2004) indicated that administrative encouragement to use technology was one of the strongest predictors of teachers' computer use. Successful implementation of integration of computers requires that the organization prepares itself to assimilate the change into its structure and activities (Tyack and Cuban 1995; Cuban 1999) and depends on the extent to which the school principals support the innovation (Venezky 2001).

Many researchers believe that the most significant factor affecting the successful implementation is teachers' support, their attitude towards it and their willingness to accept the change and invest their time (Wozney, Venkatesh, & Abrami, 2006). Teacher's professional training is essential (Dunleavy et al. 2007). Teachers' insufficient professional development has been a barrier for technology integration (Rutledge et al., 2007, Kanaya, Light, & Culp, 2005). Teachers should have knowledge, skills, and confidence to effectively design and implement lessons that integrate technology and support student learning (Donovan, Hartley, & Strudler, 2007). Similarly, many researchers indicated that teacher beliefs appeared to influence the amount of computer use in the classroom (Sclater et al., 2006; Windschitl & Sahl, 2002).

Another factor that contributes to technology implementation is the availability of infrastructure resources: hardware, quality of equipment, digital unity (Lehner et al., 2003), technical support and software (Nachmias et al. 2004). Technical problems often cause teachers to resist using laptops unless on-site support is available (Zucker & Hug, 2008). Inadequate access to computers and digital tools is a significant barrier to using technology in schools (Cuban, 2003; Warschauer et al., 2004). The initial phase of technology innovation is likely to be fraught with technical and logistical issues (Cuban, 2001a; Zhao et al., 2002).

Benefits and shortcomings

Another widely discussed topic is 1:1 computer changes classroom dynamic and learning environment, these discussion concurrent with the agreement on some benefits and shortcomings brought by 1:1 computer. Researchers agreed on that wireless laptops change class communication, information flows, classroom settings and activities, and will change the organizational structure of schools and the definition of a class (Driver, 2002).

An important change that laptop brought to classes and learning was enhanced communication and community-building. Laptops offer students more opportunities to work individually and to support group projects. Students become more accessible to each other and faculty become more accessible to students. Intranet provides additional community-building and peer-to-peer collaboration (Davies, 2004). Laptop became a means to develop a sense of community.

Some researchers also focused on exploring how laptop enhances students' learning. Mouza (2008) found that teachers in 1:1 classrooms created student-centered environments. Barron et al. (2006) suggested that in the 1:1 environment teachers were facilitated to provide students with opportunities to engage in higher order thinking. In addition, assessment of learning may change because of the more frequent exchanges between student and teacher and more ways of displaying student understanding (Wallace et al., 2000). Several studies reported that 1:1 computing resulted higher student engagement (Dunleavy, Dexter, & Heinecke, 2007; Russell, Bebell, & Higgins, 2004).

Researchers have demonstrated that laptop computers in the classroom can lead to positive educational outcomes (Finn and Inman, 2004) such as increasing students' motivation and collaboration, strengthening connections between disciplines, improving students' problem solving skills, and promoting academic achievements (Siegle & Foster, 2001). The most consistent finding is that students' and teachers' technology skills substantially improved (Murphy, King, & Brown, 2007).

Several studies describe the shortcomings of laptop usage in educational settings. A recent study found that laptop computers may increase students' non-learning usages and limit academic performance (Grace-Martin & Gay, 2001).

Students' achievements and subject learning

Some researchers explored more specific topics related to 1:1 computer, which included two topics: students' achievement and subject learning. There were limited results indicating that students' achievement increased because of laptops integration (Zucker & Hug, 2008). A number of studies have focused on the relationship between

student achievement and participation in 1:1 programs (Dunleavy & Heinecke, 2007). Gulek and Demirtas (2005) examined test scores between students participating and not participating in a 1:1 laptop program. A significant difference in both math and ELA test scores was found. However, other researchers have found the use of portable computers had a positive effect on students' science achievement, but it did not have a positive effect on English or mathematics achievements (Gardner, Morrison, Jarman, Reilly, & McNally, 1994). Zucker (2008) focued on mathematics and science instruction and did not address language arts or social science. Zucker's study (2008) found that students effectively utilized digital technology for high school physics.

Limits and gaps of prior research

Although a large body of literature about 1:1 computer exist, the real situation and actual practice of students using computer in classes and learning and how exactly laptops affect students learning remain unexplored. There are only few researches on this topic.

Findings relating to laptop use in the classroom (Demb, Erickson, & Hawkins-Wilding, 2004; Prescod & Dong, 2006; Wolff, 2006) suggest that students do appreciate the laptop and find it useful, especially for taking notes and communicating with classmates. Students had highly positive opinions about the use of wireless laptops. They perceived the laptops most useful for preparing homework, helpful in class and meetings with instructors. The students' perceptions about the advantages of the classes included: immediate help and feedback, concretizing the abstract and hands-on real-world practice. The students' perceptions about the disadvantages of the studio classes included:

problems related to class design and resources, problems related to the learning and teaching pace, and concerns related to attention distraction. Hands-on real-world practice received the highest percentage of the students' responses associated with the advantages. Research indicate that the laptop program was very well regarded by teachers and students involved in the program.

Only a few articles (e.g. Barak, Lipson, & Lerman, 2006; Fried, 2008; Kotz & Essien, 2002) provide insights into the everyday use and effects of laptops. The most frequently reported technology use was using a computer to find information on the Internet, access a teacher's web site, play computer games, take notes in class, and edit papers using a computer. Some of the less frequent in-school technology uses included using a computer to analyze data. There were numerous accounts of how 1:1 computing and wireless Internet access had changed the way students' would access information and conduct research. Laptops computers are used in classrooms for various purposes, such as management, instructional preparation and delivery, and as a learning tool (Dunleavy et al., 2007; Falba, Grove, Anderson, & Putney, 2001; Jaillet, 2004; Lei & Zhao, 2008). Positive changes that took place in the laptop classrooms including writing, information literacy, multimedia skills, and autonomy. Some activities are considered to either support learning or disturb it, and thus teachers and students need to be clear about what activities are considered appropriate. Examples of such activities are: instant messenger, surfing Wikis, searching for articles relevant for the actual lecture for later use, sharing URL with other students.

Chapter 3

Research Design and Procedures

Part I. Context, Preparation, and Data Collection

The Survey

Data presented in this paper were collected through a survey created by one faculty member and several graduate students in Instructional Systems in College of Education at Penn State University who participated in "research apprenticeship" courses as a research group of the 1:1 computing initiative, EDUCATE, throughout the year of 2009 and 2010. The survey questions were compiled from previous study questions about teacher education and 1:1 computing as well as suggestions from the research group. The purpose of this survey was to gather information from participants regarding their perceptions of the laptop impact on learning and teaching.

In the spring of 2010, the survey was tested before delivery to students, resulting in a few word changes and modification on the items; overlapping questions were removed and the questionnaire was shortened.

The survey had 28 open- and close-ended questions that explored the following topics related to student experience of 1:1 computing: (1) time spent on using MacBooks, (2) the way that MacBooks change students' view on teaching, (3) MacBook's role in leaning outside of school, (4) the way that MacBooks change the dynamic between instructor and students, (5) MacBook's impact on students' engagement and knowledge-transfer, (6) the most frequently used MacBook applications and the way students use

them, (7) the use of video and internet, and (8) students' feel about MacBook as a tool. The 28 questions included 9 Rating-scale and Likert scale questions, 4 open-ended questions, 7 Yes or No questions, and 8 multiple choice and descriptive questions. Below follows examples of questions in the survey:

- Multiple choices (Question 2, 6, 10, 13, 14, 15, 16, 18)

    Which of the following tools are you most likely to use outside of your school work? (check all that apply)

    Email iMovie iPhoto GarageBand iTunes iWeb iDVD blogs wikis Comic Life

- Yes or No (Question 3, 12, 20, 21, 22, 24, 25)

    Has using your MacBook altered the way you view teaching?

    It has

    It has not

- Open-ended (Question 4, 5, 19, 23)

    In what ways has your view of teaching been altered?

- Rating scale and Likert scale (Question 7, 8, 9, 11, 14, 17, 26, 27, 28)

    On average, what percent of class time do you spend using your notebook computer for activities related to class or activities unrelated to class?

    Class activities 10% 20% 30 40% 50% 60% 70% 80% 90% 100%

Non-Class activities 10% 20% 30 40% 50% 60% 70% 80% 90%

100%

Method justification

Although survey is not the traditional data collection method for phenomenology study, current research (Barak, 2006; Barron, 2008; Demb, 2003; Drayton, 2010; Eriksson, 2009; Grimes, 2008; Jones, 2011; Kay, 2011) on 1:1 computer often use this method to carry out mixed method or qualitative study. Also according to Marshall (1999), researchers do use survey to "learn about the distribution of characteristics, attitudes, or beliefs" and "make assumption that the characteristic or belief can be described or measured accurately through self-report and rely totally on the honesty and accuracy of participants' responses" (Marshall, p129). Strengths of surveys include their accuracy, generalizability, and convenience (Marshall, 1999). This framing is typically reserved for studies that are based on extensive interview, field observations or other collection methods that generate voluminous amounts of data. Survey, even with open ended questions do not typically do this, and the EDUCATE survey is not an exception in this regard.

Choosing of site and sampling strategy

Choosing of site follows a phenomenological approach, "the participants must be individuals who have experienced the phenomenon being explored and can articulate their conscious experiences" and "it is essential that all participants experience the phenomenon being studied" (Creswell, 1998, p. 111). This study adopts convenient sampling strategy – "the researcher obtain people who are easily accessible" (Creswell,

p115) and this sampling strategy "works well when all individuals studied represent people who have experience the phenomenon" (Creswell, p118).

Consent and IRB

Permission was sought from IRB in the year of 2009. A proposal that detailed the procedures in the study was submitted to the Office for Research Protections (ORP) at Penn State University and exemption from a full review was issued. The consent form was included at the beginning of the survey. All participants were informed that participation in the study was voluntary and that all individual responses would be kept anonymous.

Participants

The students who participated in this research were education majors in the College of Education (COE) at Penn State University. For this paper, we draw on data taken from 145 undergraduate COE students who took their Arts and Literacy block classes during the academic year of 2009 and 2010. Participating students were comfortable with technology and familiar with using MacBook tools.

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Survey distribution and response rate

In the fall semester of 2010, the survey was conducted online using Qualtrics (http://www.qualtrics.com/) survey design and administration tools. 145 students who had taken Arts and Literacy block classes in 2009–2010 academic years were invited to complete this online survey. Students were directed to a URL with the survey in one of their classes. The 145 students completed the survey during times allocated by the

researchers and class instructors. Students needed about 15 minutes to complete their survey.

A total of 145 surveys were submitted with virtually all of the questions answered. The response rate was 100%. All respondents answered virtually every question, except the 4 open-ended items, where the response rate varied such as 51% for question 4, 76% for question 5, 68% for question 23, and 14% for question 19. Because the response rates were high enough, we were confident that the data fairly represented the students' experiences and opinions.

Part II. Data Analysis

This paper reports on the results of all the 28 survey questions that examine students' perceptions about laptop impact on teaching and learning. The "mixed methods research" model (Johnston & Onwuegbuzie, 2004) is employed by using both quantitative and qualitative methodologies in the analysis and interpretation of the students' responses to the online survey.

Analysis of responses to close-ended questions

Both quantitative and qualitative data analysis methods are applied to the responses to the 24 close-ended questions, which include rating scale and Likert scale questions, multiple choices, and yes or no questions. These 24 questions addressed different aspects of laptop impact on learning and indicated students' perceptions.

Basic analyses will be conducted for all quantitative data. Analyses include both descriptive and inferential statistics. Responses to 7 out of the 28 items will be exposed to

factor analysis to sort out the result of 4 aspects and answer sub-questions. Data will be analyzed quantitatively using SPSS.

Analysis of responses to open-ended questions

Qualitative data, especially students' response to open-ended questions, will be systematically reviewed and coded for content. This study adopts a phenomenological analysis approach (Creswell, 1998, p147). The four open-ended questions include question 4, in what ways has your view of teaching been altered? Question 5, If you did not have your MacBook, what couldn't you do in your courses that you have come to rely on? Question 19; please provide a brief description of a video used for course instruction. Question 23; please provide an example of a change in the dynamic between you and your instructor.

Codes will be developed from the responses to the open ended questions and aggregated into overall themes related to laptop use. While analyzing the data, special attention will be paid to frequency of occurrence, consistency of data, countervailing findings, and relevance to the research questions. Reflective notes and memos will be taken during the analysis process.

Verification will be achieved by confirmation of different researchers, just as what Creswell (1998) suggests for verification in phenomenology study. At this stage, the author plans to have two other researchers to synthesize the responses to the 4 open-ended questions and also carry out the qualitative analysis. First, each researcher read the students' answers, classified each response. Base on these reviews, each researcher articulate interpretations reflecting on the students' views on the 4 questions. After discussion, the code will be revised to develop themes.

The scheme of analyzing survey responses in relation to sub-questions

The research question of this study is: what is the effect of MacBook use on college of education students' learning? Sub-questions are: (1) does MacBook use change students' learning and how? (2) Does MacBook use change students' perspectives on teaching and learning? (3) How do students use MacBook as a tool for teaching and learning? The research questions will be answered by addressing the three sub-questions through analyzing responses of the 28 survey questions.

The 28 survey questions and responses will be grouped into 8 aspects and analyzed to answer sub-questions. Sub-question (1) and (2) will be answered by analyzing responses of survey items of five aspects: (a) time spent on using MacBooks, (b) the way that MacBook change students' view on teaching, (c) MacBook's role in leaning outside of school, (d) the way that MacBook change the dynamic between instructor and students, and (e) MacBook's impact on students' engagement and knowledge-transfer. Sub-question (3) will be answered by analyzing responses of survey items of three aspects: (f) the most frequently used MacBook applications and the way students use them, (g) the use of video and internet, and (h) Students' feel about MacBook as a tool. The above procedure is represented in Table 3-1 (see next page).

Table 3-1. A scheme of data analysis – survey items categories related to sub-questions &

techniques applied to analyzing items

Research Question	Sub-questions	Aspects	Survey items	Analysis techniques
What is the effect of MacBook use on college of education students' learning?	(1) Does MacBook use change students' learning and how?	(a) time spent on using MacBooks	7, 8, 9	Descriptive statistics and ANOVA
	(2) Does MacBook use change students' perspectives on teaching and learning and how?	(b) the way that MacBook change students' view on teaching	3, 4	Content analysis and coding
		(c) MacBook's role in leaning outside of school	11, 12	Qualitative narrative report
		(d) the way that MacBook change the dynamic between instructor and students	22, 23	Content analysis and coding
		(e) MacBook's impact on students' engagement and knowledge-transfer	20, 21, 26	Qualitative narrative report
	(3) How do students use MacBook as a tool for teaching and learning?	(f) the most frequently used MacBook applications and the way students use them	5, 6, 10, 13, 14, 15	Descriptive statistics and qualitative narrative report
		(g) The use of video and internet	16, 17, 18, 19, 24, 25	Qualitative narrative report
		(h) Students' feel about MacBook as a tool	27, 28	ANOVA

Chapter 4

Result and Discussion

Part I. Result

Time spent using MacBook

The time students' spent using laptops for class activities and non-class activities in classes was measured by a rating scale of 10 categories from 10% to 100% of class time. An average of 59.03% of class time spent on class activities and 54.90% spent on non-class activities were reported. The median for both class time spent on class activities and non-class activities was 50%. The mode for both class time spent on class activities and non-class activities was 50%. The standard deviation for time spent on class activities and non-class activities were 1.22 and 1.45, respectively.

The time students spent using laptops per day was measured by a rating scale of 10 categories of 1 to 10 hours per day. An average of 4.8 hours per day was reported spent using laptops, with a median of 4 hours, and the mode was 5 hours and standard deviation was 0.81.

The time students spent using laptops per week was measured by a rating scale of 6 categories of 2-5, 5-9, to 26 hours and above a day. An average of somewhere between 15-20 and 20-25 hours per week was reported spent using laptops a week for school, work, and personal activities, with a median of 20-25 hours, and the mode was 20-25 hours and the standard deviation was 1.09.

In order to know how frequently students used laptop both in and out of school and for both academic and personal use, one-way ANOVA was applied to the above data to examine the following question: is the portion of time students spent using laptops different for (1) class activities in class, (2) non-class activities in class, (3) course assignment daily, and (4) school, work, and personal use weekly? To analyze this question, data obtained through question 7, 8, and 9 were converted into a 5 point Likert scale (where "1" represents "rarely" and "5" represents "constantly") and were treated as interval data (see Table 4-1).

Table 4-1.

Time spent using laptop	1 Rarely	2	3 Frequently	4	5 Constantly	Mean/ Total
In class for class activities	20%	40%	60%	80%	100%	59.03% /145
	16	35	42	34	16	
In class for non-class activities	20%	40%	60%	80%	100%	54.90% /145
	34	26	35	23	23	
Daily for course assignment	2 hours	4 hours	6 hours	8 hours	10 hours	4.8/ 145
	16	68	50	9	2	
Weekly for school, work, personal use	2-9 hours	10-14 hours	15-20 hours	20-25 hours	26 hours +	3.8 /145
	6	11	34	49	45	

Table 4-2 indicates that the results of the ANOVA found significant difference (p< .05) in time spend using laptop when examined by variables. Result from Post hoc test show that significant difference was found among time spent using laptop when compared by all other variables except the following: (1) time spent using laptop in class

for class activities and non-class activities (p= 0.433) and (2) time spent using laptop in class for non-class activities and daily for course assignment (p= 0.059).

Table 4-2

Variable	n	Mean	Standard Deviation	F	P
In class-class activities	145	2.95	1.22	37.70	.000
In class-non-class activities	145	2.74	1.45		
Daily- course assignment	145	2.40	0.81		
Weekly-school, work, and personal use	145	3.80	1.09		
Total	580	2.97	1.27		

P<0.05

The way that MacBook change students' view on teaching

When asked whether using a MacBook altered the way students view teaching, 57 students (39%) answered "it has" and 88 (61%) answered "it has not". Students' responses to the open-ended question: "what ways has your view of teaching been altered?" consisted of 51 statements. The responses were content analyzed and five main categories (see Table 4-3) were found. The students' views of teaching that had been altered included: incorporate technology into teaching (24/51), create project and present information (7/51), provide tools (11/51), transform teaching (6/51), and positive and negative evaluations (3/51). "Incorporate technology into teaching" received the highest percentage of the students' responses (See Table 4-3).

Table 4-3: Students' Perceptions about the ways view of teaching been altered

Category	Response rate (n=51)	Examples of students responses
Incorporate technology into and enhance teaching	18/51	I see more ways that technology can be integrated into the classroom
		I am more willing to try to use different things on the internet and use technology in my classroom to enhance my teaching
		I have realized that technology can have a positive impact on my teaching
Create project and present information	8/51	Using a Mac enabled me to have many opportunities for a diverse way of creating projects
		The Mac-Book allows teachers to do many activities with the students and you can also present information in a different and interesting way
		I can create great lesson on my notebook
Provide tools	12/51	We used a lot of programs including studio code, comic life, and others
		Different multimedia projects can be incorporated into lessons (iweb, imovie, comic life etc.)
		There is a lot a teacher can do in the classroom other than workbook pages, worksheets, and answering textbook questions. The Mac-book offers many programs to use to create a more effective and entertaining experience for my students
Transform teaching	10/51	Teaching cam be implemented in many structures
		I see that there are many opportunities to use technology in the classroom; I also see that this is a new trend in schools. However, I have also seen that many school districts do not have this technology, and I feel that more traditional interactive-type lessons should be taught in our blocks
		The incorporation of trans-mediation to foster the students learning in variety of methods

MacBook use outside of school

Students were asked whether the computer skills acquired for courses added novelty, enjoyment, and creativity in computer use outside of school. "Novelty", "enjoyment", and "creativity" were measured separately using a rating scale of 10 categories from 0 to 100 where 0 represents "rarely", 50 represents "frequently", and 100 represents "constantly". For "Novelty", the mean score was 38.15 with a standard

deviation of 22.46; for "enjoyment", the mean score was 46.94 with a standard deviation of 25.22; for "creativity", the mean score was 51.17 with a standard deviation of 24.89.

Students were also asked did they think personal computers play an important role in learning outside of school. 144 students answered the questions with a majority of 139 answering "yes".

The way that MacBook changes the dynamic between instructor and students

Students were asked did having MacBook in class change the dynamic between students and instructors. Among the 144 responses, 78 (56%) was "yes" and 62 (44%) was "no".

Students' response to the open-ended question: "Please provide an example of a change in the dynamic between you and your instructor", consisted of 68 statements, 35 of which were negative and 36 of which were positive. Three statements contain both negative and positive opinions. The responses were content analyzed; two negative categories and five positive categories were found. The two negative categories are "distraction and off-task (32/68)" and "laptop requirement is a restriction (3/68)". The five positive categories are "facilitate communication (17/68)", "opportunities of sharing and peer learning (4/68)", "medium for presenting materials and understanding content (8/68)", "help get various tasks done (4/68)", and "transform instruction (3/68)".

Among the negative statements, "distraction and off-task" received the highest percentage of the students' responses. This indicates that the main reason for students' negative opinion about laptop use in class is distraction and off-task behavior.

Table 4-4: Students' Perceptions about the change in the dynamic between students and

instructor

Category		Respons rate (n=68)	Examples of students responses
Negative (35/68)	Distraction and off-task	32/68	I am easily distracted during class. I tend to work ahead of the teacher when using the computer in the classroom
			People multitask and frustrate the professor because they are not fully paying attention to class discussion. This leads to things being repeated and time being wasted
			People do not pay as much attention to the teachers because they have their computers to play on
			People are more focused on their computers and less focused on their teachers
			My Mac-book is a great distraction in class. I am either searching the web or working on other assignments
	Laptop requirement is a restriction	3/68	It think it is limiting in the activities that we do, especially when instructors want assignments done in a certain way and done in a certain program on the Mac-books. Due to this and the requirement to use the Mac-books and technology, I feel limited and somewhat disconnected from instructors
			Requiring us to always have our notebooks have made us dependent on them and can distract easily
			Mac is an absolute requirement. Therefore, everything revolves around the Mac. So yes, if I did not purchase one I would be totally out of the loop with programs used in class. We HAD to buy a Mac. There was no choice
Positive (36/68)	Facilitate communicat ion	17/68	Easier to communicate and stay on the same page
			Communication is more accessible via computers. This includes email, blogs, and online assignments
			I am able to communicate with my instructors on a daily basis
	Opportuniti es of sharing and peer learning	4/68	help each other learn new ideas, students help teachers
			I feel like there is an added understanding and support between student and professor as we learn to use the computers together
			Knowing that we have the same capability to do the same work
	Medium for presenting materials	8/68	It helped us become more understanding of the content, and how we express that we know the content, through a different medium

	and understanding content		Sometimes I can actually go to the sites they are showing so that I can better pay attention and see the material
			you can follow along with what they are doing much easier
	Help get various tasks done	4/68	I can make iWeb projects for my e-portfolio
			Teachers can know that we can use the software on our Macs to help us with assignments
			Different ways to submit assignments
	Transform instruction	3/68	Learning can be more self directed. The teacher acts more of a guide
			a new way of instruction

MacBook's impact on students' engagement and knowledge-transfer

Responses to three questions indicate that students perceive laptop as useful and helpful in knowledge transfer and engagement. Among the 140 responses to the question "are the materials you create in one class useful to you in your other classes at Penn State", 87 (62%) answered "yes" compared to 53 (38%) answered "no".

When asked about "does having your MacBook help you make connections between materials in your various classes, during and/or between semesters", the students asserted relatively high positive opinions: 89 (64%) students asserted that connections were made between classes and 69 (49%) students asserted that connections were made between semesters.

Similarly, a much higher percentage of students considered laptop was helpful than those who perceived it was not, when asked their views about "how likely are you to take on an active role because you have a MacBook with you in your classes". A majority of students reported they were likely to take on an active role as a student (87 out of 139) and as a teacher (95 out of 139) because having a MacBook in classes.

The most frequently used applications and the way students use them

Students were asked about if they did not have MacBook, what they could not do in courses. Among the 76 students responded, 12 answered that they would not be able to do all the projects in courses without MacBook; 9 thought they could not do assignments because MacBook was the required tool to completing assignments; 32 named some specific tools such as iLife software, that they had to relied on; 24 stated that it did not matter if they did not have MacBook. Below follows a table displays the result of the content analysis of the responses.

Table 4-5: Students' Perceptions about what they could not do in courses they had come to rely on, if they did not have MacBook

Category	Response rate (n=76)	Examples of students responses
would not be able to do all the projects without Mac-book	12/76	Almost nothing would have been able to be done. We use all of the programs at some point in time in almost all of our classes
		Almost everything
		I would not be able to easily access technology with a different computer because this computer is very portable
		I wouldn't be able to complete all the assignments (imovie, iphoto, iweb, etc)
Assignments were required to be done with Mac	9/76	The assignments required by my courses must be done on a Mac. The only reason I rely on having a Mac over a PC is due to the requirements of my courses
		certain assignments that are required to be completed in a certain format, otherwise I do not rely on it
		The block classes have many assignments that I could not complete without the expensive Mac-book. There are multiple grades in each block that require the use of Mac applications which are only available if you own one of these expensive machines
		We have been required to use the programs iWeb and

			iMovie
Would not be able to do assignment without specific tools	The i applications provided by Mac (24)	32/76	iMovie, Garage Band/ iphoto, imovie/ Imovie, Blogs, and comic life
			use imovie, podcasts, websites, task stream, and other programs such as comic life and iphoto
			the i applications/ All the applications on the Mac-Book
	Other applications (5)		Studio Code/ PowerPoint, having my resources in hand, etc
			I did not have a camera on my other computer so I would not have been able to make movies or take pictures directly using my computer
			I use my Mac to type up all my papers, conduct research conveniently, find all my guidelines for my assignments
	Internet (3)		Use the internet
It doesn't matter if I don't have Mac book		24/76	i could do all of it on any type of laptop...i don't rely on anything that's Mac-specific
			I do not rely on any of the programs, most things could be done on windows, Mac is just simpler
			I could still do everything
			honestly, nothing

Survey item 6 explored did students use such 5 applications as iTunes, iWeb, iDVD, Blogs, and Comic Life in their SSED (Teaching Social Studies in the Elementary Grades), SCIED (Teaching Science in the Elementary School), Music ED (Music Learning and Development), Math ED (Teaching Mathematics in the Elementary Schools), seven LLED (Teaching Language and Literacy), CI (Clinical Application of Instruction), and Art ED courses.

iWeb (reported by 95 students) and blog (reported by 36 students) were used most frequently in SSED class; blog (reported by 125 students) was used most frequently in SCIED class; iTunes (reported by 63 students) was used most frequently in Music ED; blog (reported by 28 students) was used most frequently in MTHED; in 4 out of the 7 LLED classes almost none of the application was used; in other 3 LLED courses, Comic

life (reported by 108 students) was used most frequently in one class and the five applications were used evenly in the other 2 courses. Blog (reported by 49 students) was used most frequently in CI; in Art ED the 5 applications were used evenly.

Blog was the most frequently used application and it was used in 8 courses (if 10 and more students reported used an application in a course, this application was considered used by that course), followed by iWeb and iTunes and each of which was used in 4 courses, then Comic Life which was used in 3 courses, and then iDVD which was used in two courses.

Students were asked about where they acquired the skills and knowledge to use the iLife (i.e., iPhoto, iMovie, GarageBand, iWeb, iDVD) suite of software. The ways students obtained the skills included online tutorials, classroom instructor, EDUCATE workshops, peers in the college of education, peers outside of school of education, and other. Among these "classroom instructor" had the highest response rate. 52 out of 144 students reported they learned iMovie this way, 27 out of 142 reported they learnt iPhoto this way, and 82 out of 139 reported they learnt GarageBand this way.

Students reported that their primary reasons for using a computer beyond course and assignments were contacting family and friends and entertainment. The majority (110 out of 140, 79%) answered "to communicate with friends and family", 19 answered "to research ideas" and 11 answered "other". Other reasons include internet searches, look up information for leisure (current events), writing paper, surfing the web, entertainment, watch movies, networking, face book/music, communication, and reading blogs.

Students were asked about how frequently they use a list of applications (see Figure 4-1). This questions was measured by a 10 categories rating scale from 0 to 100

where 10= never, 30= rarely, 50=sometimes, 70=frequently, and 90=always. Students were asked to choose a score from the 10 categories.
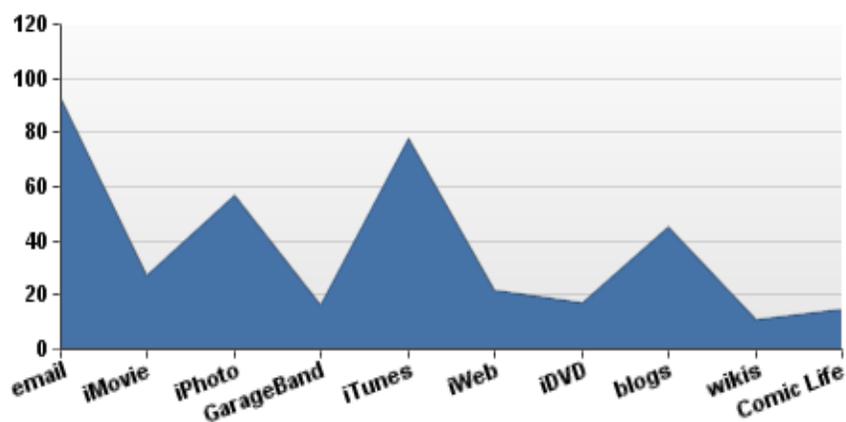

Figure 4-1.

From the figure we can see that email (mean = 92.63) and iTunes (mean = 78.18) were used most frequently, followed by iPhoto (mean = 56.96) and blogs (mean=45.14). The less frequently used applications were iMove (mean = 27.29), GarageBand (mean= 16.41), iWeb (mean = 21.71), iDVD (mean= 16.92), wikis (11.25), and Comic life (mean= 14.97).

Students were also asked about which of the above mentioned applications were most likely to be used outside of school work. Email (137 responses, 96%), iTunes (123 responses, 87%), and iPhoto (103 responses, 73%) were chosen by most students; followed by iMove (24 responses), iDVD (10 responses), and blogs (8 responses); and Garageband, iWeb, wikis, and Comic life were chosen by less than 8 students.

Students' use of video and internet

According to students, in classes, when teachers use video for instruction, view is most often on a classroom computer (104 responses), and in much less chances view is in on students' own computer (28 responses).

When asked about how important is the use of video in their preparation to become a teacher, 97 (56%) students answered "somewhat important", 37 (26%) students answered "important", and 24 (17%) answered "not important".

When asked about how many videos they created with their own MacBook, a majority students (98, 70%) answered they created 1-4 videos; 36 created 5-9 videos. 7 students answered they created more than 10 videos.

Students provided brief description of the video used for course instruction. 14 students described the video used in different courses included SSED, Art Ed, LLED, and Math Ed. 3 students mentioned they created video for classes using iMovie and YouTube. 1 negative statement was "we had to use studio code to record a lesson and make notes on the video. It was a horrible, horrible program".

Students also reported about their perception of using internet. They were asked whether they were more likely to participate in class because having an internet connection. 72 students answered yes and 67 answered no. However, when asked did MacBook with Internet access in classes empower they as a learners, 57 (41%) agreed and 19 (14%) disagreed. Students perceived that internet accesses facilitated learning.

Students' perceptions about MacBook as a tool for teaching and learning

When asked about how they feel about MacBook as a powerful tool for learning, 68 out of 139 answered "agree", 18 answered "strongly agree", 42 out of 139 neither agreed nor disagreed, 7 disagreed, and 4 strongly disagreed.

When asked how effective was a MacBook as a tool for learning and teaching, 78 students considered it as "effective" for learning and 67 students considered it "effective" for teaching; 13 students considered it "extremely effective" for learning and 13 students considered it "extremely effective" for teaching; 37 considered it neither effective nor ineffective for learning and 41 considered it neither effective nor ineffective for teaching. 10 students considered it ineffective or extremely ineffective for learning and 15 considered it ineffective or extremely ineffective for teaching.

In order to know students' attitude toward MacBook as teaching and learning tool, one-way ANOVA was applied to the above data to examine the following question: is there any difference among (1) students' feelings about the powerfulness of MacBook as tool for learning, (2) students' evaluation of MacBook's effectiveness as a tool for learning according to their experience, and (3) students' evaluation of MacBook's effectiveness as a tool for teaching according to their experience. Data gathered through question 27 and 28 were converted to a 5 point Likert scale, where "5" represents a strongly positive attitude and "1" represents a strongly negative attitude, and were treated as interval data (see Table 4-6).

Table 4-6.

	5	**4**	**3**	**2**	**1**	**total**
Perspective: powerful tool for learning	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	
	18	68	48	7	4	145
Experience: a tool for learning	Extremely Effective	Effective	Neither Effective nor Ineffective	Ineffective	Extremely Ineffective	
	13	78	44	7	3	145
Experience: a tool for teaching	Extremely Effective	Effective	Neither Effective nor Ineffective	Ineffective	Extremely Ineffective	
	13	67	50	9	6	145

Table 4-7 indicates that the results of the ANOVA found no significant difference (p>.05) in students' attitude toward (mean= 3.57) MacBook's powerfulness and effectiveness as a teaching and learning tool when examined by variables.

Table 4-7

Variable	n	Mean	Standard Deviation	F	P
Feeling: powerfulness as learning tool	145	3.61	0.87	1.03	0.34
Experience: effectiveness as learning tool	145	3.62	0.80		
Experience: effectiveness as teaching tool	145	3.49	0.90		
Total	435	3.57	0.86		

P< 0.05

Part II. Discussion

Time spent using MacBook

This study shows that laptops were frequently used in and out of school. More than 50% of class time was spent with laptop by the students and they spent almost 5 hours a day for course assignment and approximately 20 hours a week using laptops.

However, time was not evenly spent for school and personal lives; this was indicated by the ANOVA and Post Hoc tests. In classes, half of the class time was spent using laptops and was spent almost evenly for class activities and non-class activities. Although students use laptop frequently for course assignment, they might use it more frequently for work, non-academic, and personal purpose. Laptop use had become an integrated and important part of students' lives in and out of school.

This result echoed with findings from Kathryn Holleque's survey of students at Valley City State University (VCSU). By 2002, data from Holleque's (2002) six-year longitudinal research showed 78% of students using their computers at least four or more times a day for a variety of academic and personal uses, with an 13% using them at least three times daily.

The way that MacBook change students' view on teaching

In our study, although a majority of students considered MacBook did not alter the way they view teaching, the 39% of students who considered MacBook altered the way they view teaching offered various opinions on how it changed their views about teaching. Content analysis reveals that MacBook changed their views about teaching mainly in two ways: (1) they realized technology had a positive impact on teaching and were more willing to incorporate technology in teaching and (2) they saw themselves more effectively in utilizing tools for different instructional purposes.

The result was in accordance with Kay's (2011) findings in exploring the benefits and challenges of using laptop computer in higher education classrooms. In the study, data reported by students in laptop-based classes reflected instructors' attempts to

meaningfully incorporate laptops into classroom instructions by using various applications such as online surveys, web-based searches, videos, and online materials.

The result was echoed in Jones' (2010) findings in evaluating a national laptop initiative among New Zealand teachers. In the study, teachers found laptop with multimedia capability allowed them to make more use of visual materials and promoted students' understanding and interest.

The result parallel the findings from Allsopp's (2009) survey that examined perceptions of integrating technology in a teacher education program. Result of the survey suggests that (1) pre-service teachers' self-perception of their ability to use technology for teaching increased and (2) a positive attitude toward integrating technology across semesters. Barron's (2008) findings from students' survey on perception on laptop also revealed that students felt they would be better teachers as a result of their experience in laptop initiative in teacher preparation at University of South Florida.

The result is consistent with Barak's (2006) findings and analysis of students' perceptions of laptop use in teaching. In the study, students perceive laptops as useful cognitive tools, because laptops facilitate understanding of learning materials and abstract concepts by enabling exploratory learning via web and visualization. Another study (Klieger, 2009) on integrating laptop in classroom in professional development of science teachers in Israel also found that introducing laptop in teachers' professional development changed teaching methods, brought about a shift from teacher-centered teaching to student-centered teaching, and more stuff members started introducing technology means into lessons.

To conclude, laptop environments not only change teacher's and future teacher's views of teaching but also change their teaching practice. Teachers and learners believe technology is an integrated part of teaching and consciously put effort in promoting utilizing technology in teaching.

MacBook use outside of school

Although almost all students in our study considered laptop played important role in learning outside of school, they did not think laptop skills acquired for courses added much novelty, enjoyment, or creativity in computer use outside of school. This was probably because computer skills acquired for courses were not used outside of school for activities that were perceived by students as enjoyable, novel, or creative.

However, students' view of laptop played important role outside of school was consistent with Eriksson's (2008) study of students' use of laptop in the University of Lapland in Finland. That study took a further step in exploring the flexibility and effectiveness brought about by laptops in learning outside of classes.

The way that MacBook changes the dynamic between instructor and students

Our study demonstrated that 56% students considered MacBook changed the dynamic between instructors and students and 44% considered it did not. Almost equal number of students offered positive and negative opinions when they gave examples of the changes. Facilitating communication and proving medium for presenting materials were acknowledged as important benefits; distraction and off-task behavior were the major negative impact.

Previous research (Barak, 2006; Barron, 2008; Demb, 2004; Kay, 2011) had similar findings about the positive impact of laptop on communication. Barak's (2006) study found laptop facilitated immediate feedback, in-class collaboration, and sharing work and ideas. Students' comments from Barron's (2008) survey were centered on the ease of collaboration through iChat and other applications that enhanced social network.

The fact that introducing of laptop into classrooms also contributed to distraction and off-task behavior was also discussed by previous research (Barak, 2006; Demb, 2004; Lindroth, 2009). In Barak's study, 12% of students used laptop for non-learning purpose such as surfing web, emailing, and messaging each other and 15% of students indicated laptop with wireless connection distracted their attention in class; one third of the students in Demb's (2004) study reported that laptop may had been a distraction.

Lindroth's (2009) study offered detailed description and analysis on students' activities of leaning and non-learning purpose related to laptop use in class. According to Lindroth (2009), students were uncertain about what activities of laptop use were considered appropriate; they considered that laptop reduced boredom during uninteresting lecture; some activities for non-learning purpose did happen, such as sending amusing videos and giving comments to each other and these activities made students lose track of the lecture. Base on analysis, Lindroth (2009) gave suggestion on establishing strategies on how to handle students' inappropriate use of laptop in class, these included: developing a learning culture that encourages students to take responsibility for their learning; turning instant messenger to "do not disturb" mode and closing email client during lectures.

MacBook's impact on students' engagement and knowledge-transfer

Survey results from our study suggested that a majority of students considered they were more likely to take on an active role as student and teacher because they had MacBooks; 62% of students considered the materials they created in one class useful in other classes in Penn State; 64% of the students considered MacBook help make connections between materials in various classes during or between semesters.

The result was slightly contradictory to the result of Barak's (2006) online survey, which indicated that students were not too keen about being active in class. However Barak (2006) offered an explanation – being familiar with traditional teaching, students found it odd to be active in laptop class environment. Although according to Barak (2006), some other studies established that most curriculum changes were accompanied with difficulties and resistance, this seemed did not apply to the students in our study. This was probably because the students in our study had already developed a familiarity with and skills of using laptop use in learning.

The result was echoed in Demb's (2004) findings in explore students' perception on using technology in a small university in Ohio. In the study, large percentages of the students agreed that technology increased students' engagement by increasing critical thinking. Elwood's (2006) study about individuals' acceptance and using technology in higher education also showed a positive students' attitude toward laptops. Eriksson (2009) examined laptop impact from the perspective of flexibility and effectiveness. According to Eriksson (2009), laptop with internet connection made it possible for students to choose study modes, the places and time for studying, and thus contributed to

study motivation and increased students' proactive effort, persistence, and sense of responsibility.

The most frequently used applications and the way students use them

In our study, blogs were reported the most frequently used application in eight art and literacy courses for education majors; the less frequently used applications in these courses were iWeb, iTunes, Comic Life, and iDVD. Outside of school work, the most frequently used applications were email and iTunes. Students reported that they acquired the skills to use these applications mainly from classroom instruction. They also reported that the primary reason for using laptop beyond course assignments was communicating with friends and family.

There were few studies on frequently used laptop applications. The only research reported on this topic was Jones' (2010) evaluation of laptop initiative for New Zealand teachers. Findings of this study showed that science, art, and social science teachers were generally enthusiastic about using images, animations and simulations, and real-world data that were accessed through laptops.

Students' use of video and internet

82% of students in our study considered that use of video in their preparation to become a teacher were important or somewhat important. 70% of students reported that they created 1-4 videos during the semester and video were used in 4 different art and literacy courses. According to our study, when teacher were using video for instruction, the viewing was most often on a classroom computer, not students' own laptop.

Half of the students considered that they were more likely to participate in class because of the internet connection and the other half did not think so. This was in

accordance with the result that the biggest disadvantage of using laptop in class was distraction. However, a majority of students considered that internet access in class empowered them as learners.

Students' perceptions about MacBook as a tool for teaching and learning

While evaluating MacBook as a tool for courses learning, almost half of students agreed they needed to rely on MacBook tools to complete courses assignments. Responses from some other students suggested MacBook tools were the required medium for completing assignments. Students exhibited a consistent and highly positive attitude toward MacBook's powerfulness and effectiveness as teaching and learning tool. This was echoed in findings of many other studies of laptop use among college students (e.g., Barron, 2008; Demb, 2004; DiGangi, 2007; Elwood, 2006; Eriksson, 2009; Jones, 2011).

Below follows a table that summarizes the findings of the eight aspects.

Table 4-8

Aspects	Findings
Time Spent using MacBook	Laptops were frequently used in and out of school. More than 50% of class time was spent with laptop by the students and they spent almost 5 hours a day for course assignment and approximately 20 hours a week using laptops. However, time was not evenly spent for school and personal lives; this was indicated by the ANOVA and Post Hoc tests. Outside of school, although students used laptop frequently for course assignment, they used it more frequently for non-academic and personal purpose.
The Way MacBook Changes Students' View on Teaching	Although a majority of students considered Mac-book did not alter the way they view teaching, the 39% students who considered Mac-book altered the way they view teaching offered a variety of opinions on how it changed their views. Content analysis revealed that MacBook changed their views in two ways: (1) they realized technology had a positive impact on teaching and were more willing to incorporate technology in teaching and (2) they saw themselves more effectively in utilizing tools for different instructional purposes.
MacBook Use	Students agreed laptops played important role in learning outside of

Outside of School	school. However, students did not think laptop skills acquired for courses added novelty, enjoyment, or creativity in computer use outside of school.
MacBook's Impact on Students' Engagement and Knowledge Transfer	Students agreed they were more likely to take on an active role as student and teacher because they had MacBooks with them. 62% of the students considered the materials they created in one class useful in other classes. 64% of the students considered MacBook helped make connections between materials in different classes during or between semesters.
The Most Frequently Used Applications and the Way Students Use Them	Blog was reported the most frequently used application in eight art and literacy courses for education majors; the less frequently used application in these courses were iWeb, iTune, Comic Life, and iDVD. Outside of school, the most frequently used applications were email and iTunes. Students reported that the primary reason for using laptop beyond course assignments was communicating with friends and family. There was few previous research on frequently used laptop applications.
Students' Use of Video and Internet	82% of students considered that use of video in their preparation to become teachers were important or somewhat important. 70% of students reported that they created 1-4 videos during the semester in 4 different art and literacy courses. According to our study, when teacher were using video for instruction, the view was most often on a classroom computer, not students' own laptops. A half of the student considered that they were more likely to participate in class because the internet connection and internet access in class empowered them as learners.
Students' Perceptions about MacBook as a Tool for Teaching and Learning	Almost half of students agreed they needed to rely on MacBook tools to complete courses assignments. Responses from the other half of the students suggested this might because MacBook tools were the required medium for completing assignments. In spite of the above different opinions, students exhibited a consistent and highly positive attitude toward MacBook's powerfulness and effectiveness as a teaching and learning tool.

Chapter 5

Conclusion and Research Reflection

Summary of result

To conclude, the findings of this study include the points below that answer the research questions and sub-question. The research question is: What is the effect of MacBook use on college of education students' learning? The quesetion is answered by addressing the three sub-questions below.

(1) Does MacBook use change students' learning and how?

More than half of the students considered Mac-book changed the dynamic between instructor and students, either positively and negatively. The biggest advantage was enhanced communication and medium for presenting materials; the major concern was MacBook could become a distraction. Most students reported laptop use enhanced students' engagement and helped with knowledge-transfer, i.e., making connections between courses and semesters. Students use laptop frequently for academic and personal purpose; laptop use had become an integrated and important part of students' lives in and out of school.

(2) Does MacBook use change students' perspectives on teaching and learning and how?

MacBook use started to change the way pre-service teachers view teaching. They saw themselves more effective in utilizing technology tools for different instructional purpose, believed technology could impact teaching in a positive way, and were willing to incorporate technology into teaching.

(3) How do students use and view MacBook as a tool for teaching and learning?

Blogs was considered as the most frequently used application in art and literacy courses for education majors; outside of school, the most frequently used application were email and iTunes. The less frequently used applications included iWeb, iTunes, Comic Life, and iDVD. Students considered use of video was important in the preparation to become a teacher. Internet was seen as helpful to active class participation and empowered them as learners, although sometimes it could become a distraction. Students exhibited a consistent and highly positive attitude toward MacBook's powerfulness and effectiveness as teaching and learning tool.

Overall, there was a trend that students exhibited a positive view of laptop use in teaching and learning. They saw themselves more effectively utilizing laptops in teaching and learning and believed technology positively impact teaching; they saw the dynamic change between instructors and learners and agreed that laptops empower them as learners and improved students engagement and knowledge transfer; they became familiar with a variety of audio-visual and web tools and the usability for different instructional purpose. Educators and policymakers should see this positive trend in teacher preparation, develop and improve strategies to cope with this trend, and thus improve teaching-learning with new technologies.

Implication

This paper aims at exploring the experience and perspectives of College of Education students about laptop use in teaching and learning and offering detailed and rich description. The students in College of Education will become future teachers of next digital generations. By offering description about laptop use in pre-service teachers' teaching and learning, their experiences, behaviors, shared culture, and the meaning they ascribe to these experiences, this research is expected to help with the preparation of future teachers in digital teaching-learning environments.

This study did not intend to evaluate the quality and effectiveness of 1:1 laptop initiative; also it did not intend to describe the experience of laptop use in K12 settings. Rather it intends to provide useful insights into understanding students in College of Education, i.e., pre-service teachers' experience with laptop in teaching and learning.

Several things were learned from this study that can be used in pre-service teacher preparation in 1:1 environment. First, it is important to know students attitude toward laptop as teaching-learning tools and their belief and willingness to utilize the tool in educational practice; second, this study helps gain a perspective on current College of Education students', i.e., future teachers' view on the dynamic between instructors and learners in a laptop environment and thus help improve teaching-learning practice with laptops; third, this study investigated the time students spent using laptops and the frequently used laptop applications, this information could also help develop and improve technical training strategies for pre-service teachers.

The students in our study already acquired a certain technical proficiency and were familiar with laptop class environment. It cannot be taken for granted that all pre-

service teachers have good computer skills to put laptop into use in teaching and learning. And thus there are limitations for us to generalize from the findings to all 1:1 programs.

Future research

This study only depicted the overall experience of laptop use by students from eight art and literacy courses and did not look deep into the use of different applications in different courses. Future research could explore the use of certain applications in a specific course, for example, the use of video in science education courses.

This study showed that in spite of positive students' view and practice of teaching-learning with laptop, the biggest disadvantage was distraction and off-task behavior. Future research could explore the strategies to prevent distraction and off-task behavior, especially among K12 students in laptop environment, because comparing to college students, K12 students are more immature in self-management.

This study adopted both qualitative and quantitative data and analysis method to explore several aspects of students' experience and perspectives of laptop use in teaching and learning, and can serve as a basis for further qualitative study on related topics. In this study, the qualitative data obtained through open-ended survey questions were short and brief answers and lack of depth. Therefore, another area for future research is a more focused, in-depth qualitative study that using in-depth interview and participant observation to explore (1) the dynamic between teachers and students in classroom or (2) how do students use laptop as teaching-learning tool, and offer more detailed and richer description.

Limitation and data validity

Two limitations of the data presented in the study need to be considered. First, we relied on self-reported data, which is subject to bias, including a subconscious of researchers and students who participated in survey trying to present laptop use in education in a favorable light. We attempted to control for such bias through careful question design. Second, the study did not involve data from in-depth interview and participant observation; this could weaken the features and strength of a phenomenology study.

However, validity was achieved by "an ongoing dialogue regarding interpretations of the informant's reality and meanings will ensure the truth value of the data" (Creswell, p203). The research group continually discussed the survey result to ensure the interpretation reflect the reality. Also the paper is attempting to ensure validity by including the detailed account of the focus of the study, context for which data were gathered, and report of data collection and analysis strategies.

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