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An Exploration of Female Emirati Students' Experiences with the Use of Laptops in Mathematics Classrooms

دراسة حول استخدام التلميذات الاماراتيات الكمبيوتر النقال في صفوف
الرياضيات

By

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Abstract

This study was designed to explore the students' experiences with laptops used in mathematics classrooms in a college at the United Arab Emirate, during the first year of laptop program implementation. The study aimed at investigating how laptops were utilized by both the students and teachers to learn mathematics, exploring the students' attitudes towards it, and capturing teachers' reflections on the experience. Specifically the research questions that guided the study are:

1. In what ways were the laptops utilized in mathematics classrooms during a period of two semesters (one year 2009-2010) by both the students and the teachers?
2. How did the students feel about using the laptops in learning mathematics?
3. How do the mathematics teachers evaluate using laptops by the students in their classes?

Both qualitative and quantitative methods were used to collect data including: student questionnaires, teacher questionnaires, classroom observations, focus groups with students and interviews with the teachers. The sample of this study consisted of 58 female emirate students at the foundation level of a government funded college and their three mathematics teachers.

The findings of the present study reveal that despite of the reported benefits of using the laptops in mathematics classrooms; students were facing some difficulties in the first year of implementation of the laptop program and so developed negative attitudes towards the use of laptops to learn mathematics. Recommendations, based on the findings of the research, are suggested at the end of this paper and are addressed to both mathematics teachers and decision makers at the college for improvement of the program in the coming years.

KEYWORDS: laptops, one-to-one computing, mathematics learning, attitudes, ubiquitous computing, UAE.

صمم هذا البحث لدراسة تجربة استخدام التلاميذ للكمبيوتر النقال في صفوف الرياضيات بمؤسسة للتعليم العالي بدولة الامارات العربية المتحدة، وذلك خلال العام الأول من تطبيق مشروع استخدام الكمبيوتر النقال في جميع الصفوف بالكلية. هدفت هذه الدراسة للاستطلاع على كيفية استخدام التلاميذ والمعلمين للكمبيوتر النقال لتعلم الرياضيات، ومعرفة شعور التلاميذ حول هذا الاستخدام و رأي المعلمين بهذه التجربة. تحديداً، هدفت هذه الدراسة للاجابة على الأسئلة التالية:

السؤال الأول: كيف تمّ استخدام الكمبيوتر النقال في صفوف الرياضيات من قبل التلاميذ و المعلمين في السنة الدراسية

2010-2009؟

السؤال الثاني: كيف كان شعور التلاميذ اتجاه استخدام الكمبيوتر النقال في تعلم الرياضيات؟

السؤال الثالث: كيف يقيم معلموا الرياضيات استخدام التلاميذ للكمبيوتر النقال في الصفوف؟

تم استخدام وسائل كمية و نوعية لجمع معلومات تشمل: استبيان للتلاميذ، استبيان للمعلمين، زيارة صفوف، مجموعات نقاش مع التلاميذ، و مقابلات مع المعلمين. اشترك في هذه الدراسة 58 تلميذة اماراتية من السنة الدراسية الأساسية في كلية حكومية في الدولة و ثلاث معلمين لمادة الرياضيات في الكلية.

تبيّن هذه الدراسة بأنه وعلى الرغم من الحديث عن بعض الفوائد لاستخدام الكمبيوتر النقال في صفوف الرياضيات، واجهت التلميذات صعوبة بشكل عام وذلك خلال السنة الأولى من تطبيق مشروع استخدام الكمبيوتر النقال في جميع الصفوف بالكلية، مما أدى الى ظهور مواقف سلبية اتجاه هذا الاستخدام. وبناءً على هذه النتائج، تم ارفاق هذا البحث بمجموعة من التوصيات موجهة الى المعلمين وكذلك أصحاب القرار القيمين على المشروع في الكلية، لتحسين نتائج هذا المشروع بالسنوات القادمة.

Dedication

I dedicate this study to my son Kareem who lightens my life with his presence.

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I am very grateful to my advisor Dr. Naz Awan for her extra support, guidance and encouragement.

To my husband, who encouraged and supported me and all through the research journey.

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CHAPTER 1

RESEARCH OVRVIEW

1.1 Introduction

In 1985, Alfred Bork stressed that the way people learn will dramatically change because of technology and he prophesied how computers would affect education in the future when stated:

We stand at the beginning of a major revolution in the way people learn ...We are moving rapidly toward a future when computers will comprise the dominant delivery system in education for almost all age levels and in most subject areas. Not since the invention of the printing press has a technological device borne such implications for the learning process (1985, p. 3).

Symonds (2000) supported Bork's vision when he predicted that in 2018 high schools will be much different that it will be "High tech High". Both Bork's prophesy and Symonds vision are becoming realized in today's schools and universities. Computers and specifically laptops are becoming essential equipment in the classrooms of higher education and there is a rapid grow in the number of colleges and universities that are implementing the 1-to-1 laptop programs all over the world (Weaver & Nilson, 2005 cited in Fried, 2008, p. 906). However, while enormous number of research studies suggests positive gains in learning and academic achievement when students are using laptops (e.g. Lowther, Ross & Morrison, 2003; Rockman et al, 2004; Rockman, 2007), other studies reveal the negative impact of using laptops on students learning (e.g. Melerdiercks, 2005; Young, 2006; Roda & Thomas 2006 cited in Fried, 2008). The New York Times reporter Hu (2007) had reported on some efforts at schools and universities to block or ban laptop use and revealed that parents and students have begun to discuss and talk about the potential problems of distraction that laptops cause when students use it for non-educational purposes.

1.2 Background of the study

With the growth of the number of the laptops initiatives in higher education all over the world, the Arab World is also following the same trend (Sultan, 2002 cited in Makrakis, 2002) and in specific The United Arab Emirates (UAE) which is one of the countries in the region that is heavily adopting technology in education. The Government of the UAE has paid considerable funds to develop education, taking into consideration the importance of ICT as a *national priority* (Makrakis, 2002). The Ministry of Education and Youth of UAE developed the Vision 2020 document that states its visualization for education throughout the period 2000 to 2010 and this vision emphasizes the use of multimedia-based instructional materials in the educational institutions and urges that upper secondary schools should provide a computer ratio of 1:1 (MoEY, 2000).

As a result, many educational institutions in the UAE adopted the path of providing personal laptops to the students aiming at providing them with better quality of instruction and preparing them for the demands of the modern life. In 2009-2010, all the students and the teachers of the foundation level at a college in the United Arab Emirates, received wireless laptop computers to use at both home and college. It was required from the students to bring their laptops to every class and the teachers were supposed to develop instructional materials for full laptop sessions. With the use of laptops by students in the college classrooms, new learning environments have been created and thus there was a need for conducting a study to evaluate the implementation of the program and determine the conditions under which gains and positive effects on students learning can be achieved.

1.3 The study rationale and research questions

A lot of research studies have been conducted to assess the effects of the use of laptops in classrooms (e.g. Rockman et al, 1997; Lowther, Ross & Morrison 2003; Rockman, 2003; Harris & Smith, 2004); but because most of the 1-to-1 laptop initiatives are relatively new

there still a lot to be learned about its effect on teaching and learning and more reliable information is needed about the situation when every students has a laptop (Zucker, 2004). The laptops initiatives in the United Arab Emirates did not start officially before the year 2000 (e.g. the Dubai Women's College initiative in 2000 and the Intel Notebooks for Books with at Al Mawakeb school in 2006). This leads to the heavy need for more research on using the laptops in classrooms by Emirati students at the UAE schools and universities.

Studies suggest that laptops are being used the least frequently during the mathematics classes compared to other subjects like Languages and sciences (Lemke & Martine, 2004, cited in Holcomb, 2009). Therefore, it is worth to conduct a study that investigates the use of laptops in mathematics classes and explores the students' attitudes about it.

In educational scenarios, teachers and students are the "main potential adopters" of technology and it is important to understand their perceptions towards using it. Numerous researchers argue that "while implementing a new technology, educators should evaluate how and why students learn via the new technology in order to help with curriculum and instructional designs" (Manocherhi & Sharif, 2010).

The purpose of this study is to investigate the first year of the implementation of the laptop project in the college, looking closely at the way of incorporating it into mathematics instruction and the impact of this integration on the students' educational experiences. Specifically, the leading questions of this research are:

1. In what ways were the laptops utilized in mathematics classrooms during a period of two semesters (one year 2009-2010) by both the students and the teachers?
2. How did the students feel about using the laptops in learning mathematics?
3. How do the mathematics teachers evaluate using laptops by the students in their classes?

To answer these questions, the researcher collected data both quantitatively and qualitatively through students and teachers questionnaires, classroom observations, interviews with the mathematics teachers and focus groups with the students.

It is believed that the results of the current study are important in the following aspects:

1. Policy planners and administrators at the schools and universities specifically of the United Arab Emirates can find this study useful because it helps them understand how teachers and students perceive the use of laptops in their classrooms, especially during mathematics classes.
2. The study took place at the first year of following the laptop program. The results might help decision makers in making the necessary adjustments in their planning for the coming years.
3. The students' responses to the questionnaire, specially the part where students are asked to state the advantages and the disadvantages of the laptops and to give suggestions to improve the way to use it in the classrooms; will be very beneficial to teachers to improve the implementation of laptops in the classes.
4. This study can help the curriculum unit at the college, specially the mathematics course planners while designing the content of the course. It is critical to redesign the curriculum to fit the new technology (laptops) used by students in the classes.

CHAPTER 2

The 1-to-1 INITIATIVES IN EDUCATION

2.1 History of the 1-to-1 initiatives

A laptop program or the one-to-one computing program in education simply means to provide a computer to every student (Jackson, 2009). The 1-to-1 computing is an initiative which was originally created by some big companies such as Microsoft, HP, Dell, Apple and Intel where “every student or teacher is given to a computer, the internet, and software anytime and anywhere. The term computer is used to mean a personal computer, laptop, netbook, handheld, or tablet” (Wikipedia, 2011). Globally, there is a rapid expansion of the one-to-one laptop programs across schools and universities and these initiatives vary broadly in their extent; from providing laptops with internet access across a district to thousands of students, to introducing laptops into instruction and experimenting classroom-by-classroom (Rockman, 2003). According to Saul Rockman (2004, p.35) who is a pioneer researcher in the field of technology in education, the number of the initiatives is increasing so that:

At least one of every six U.S. district now has some form of a laptop program in one or more schools, encouraged by both the falling prices of computers and the positive public perception generated by promoting such an initiative.

The Indiana’s Buddy Project that began in 1988 is one of the pioneer efforts to provide students with computers at home aiming at increasing the students’ achievement using *any time- anywhere* technology. The project was initiated by a group of Indiana business and education leaders as “The-Computer-in-the-Home” project where the families of the fourth and fifth grade students of selected schools across the states, were provided with a computer, printer, and modem and the training to use them. The initiative main goal was to increase the family involvement in education and to extend learning beyond the boundaries of school. The

initiative extended over the years and succeeded in creating a new kind of connection between the family and school (<http://www.buddyproject.org>)

Another high-profile program was the “Anytime Anywhere Learning” project. The project was sponsored by Microsoft Corporation and Toshiba American Information Systems’ Notebooks for Schools, and was launched in 1996 including 52 schools across the United States. Both students and teachers were given laptops burdened with Microsoft products to use 24 hours a day, 7 days a week (Rockman et al., 1997). To assess the laptop program implementations, an independent research, evaluation and consulting company (Rockman et al, 1997) conducted several evaluation studies over the next years. These studies found in general a link between using personal laptop computers and improved teaching and learning. For example, students of the laptop program were engaged in more collaborative work and project based learning activities that improved their research and critical thinking skills and teacher were more motivated to teach.

Many other large initiatives occurred over the past decades including Maine’s Laptop Program that was initiated in 2000 and expanded later to include more than 33,000 students and 3,000 teachers in 2003; the Henrico Country Schools program in Virginia that started in 2001 to include more than 23,000 students in 2003; and the Texas Technology Immersion Project in 2005 than included thirteen schools with more than 7,300 students (Gulek & Demirtas, 2005). Besides these large initiatives, smaller budget laptop programs were taking place, started from the efforts of individual teachers and administrators in an attempt to grip the technological change (Rockman, 2003). And now universities are spending millions to build laptop friendly facilities and provide wireless internet access on campus for the students to help them learn and research (Jones, 2005). Brown & Petitto (2003) used the term “Ubiquitous Computing” to refer to “a campus where all students and faculty have laptops and all buildings have access to wi-fi technology” (cited in Fried, 2008). Whether it is called

a laptop program, a 1-to-1 computing, or ubiquitous computing it is definite that these programs are changing the way students learn and teachers teach (Mouza, 2008).

2.2 The 1-to-1 initiatives and learning

Using laptop computers in classrooms are leading to a big change in the teachers' instructional techniques and the students' ways and tools of learning (Rockman, 2003). With laptops students from any location and at any time, can have access to any information they need and are able to communicate and present their ideas in innovative ways. Students do not have to spend long hours at the school library searching for information. Instead, they have all the tools needed to "gather, store, organize, analyze and represent information" at their fingertips (Sahl & Windschitl, 2000, p.4). With the ability to use the laptops at both home and school and with full Internet access, it is easier now for students to "access a wider array of resources to support their learning, to communicate with peers and their teachers, and to become fluent in their use of the technological tools for the 21st century workplace" (Crawford & Vahey, 2002). Furthermore, with the possibility to take their laptops home, students even have a wider access to information and are able to organize their work and this helps in making the laptop a more *personal* device (Crawford & Vahey, 2002).

Numerous research studies have been conducted to evaluate the impact of using laptops in classrooms on teaching and learning. Some of these studies succeeded in painting an inspiring picture of the potential of the laptop projects in schools. Among these studies is a four-year investigative study of "The Tech-Know-Build project", a project in which 3,000 students and 175 teachers were provided with laptops and wireless internet access in Indianapolis and Crawfordsville. The study was conducted by Rockman et al (2004) and the results were based on qualitative and quantitative research methods that included extensive interviews, surveys, focus groups and classroom observations. According to Rockman et al (2004), laptops increased the students' motivation and experimentation and helped in the shift

to more project-based learning. Half of the teachers in the study reported that laptops helped the students in developing better organizational skills by keeping track of their projects and using an agenda program to place up daily reminders and deadlines. Not only the students improved their technology skills and had greater engagement in their work, with the laptops they enjoyed writing more and had higher daily attendance. The study showed also that laptops helped with the shift to more collaborative learning in the classrooms. Students worked together on projects and were free to move around to help each other and teachers acted as facilitators of the learning by roaming about the classroom and helping those who need remediation or have problems. With laptops, teachers were free to change their assessment techniques by assigning presentations and multimedia projects to students and they used rubrics to evaluate the work. Students were experimenting more and had the choice to decide on the resources and material to use in their projects, and were doing reports and presentations on the results of their studies.

Another research carried by Lowther, Ross & Morrison (2003) to study the impact of 24-hour access to laptops on classroom activities for the fifths, sixth and seventh-grade students revealed that students were pleased in general about having laptops because they had easy access to online resources and were able to make their assignments look better. The students indicate also that learning that is more cooperative took place when they had the laptop because they were able to send e-mails to team members to finish their projects quickly. More science and social studies project work were done and the level of learning was higher because teachers expected more from the students who had laptops. Teachers also indicated that students with laptops are better writers because “they are not afraid to write--they can delete and redo a paper much easier” (Lowther, Ross & Morrison, 2003).

In his article “It’s my laptop”, Rockman (2007) argues that owning laptops gives students a sense of pride, possession, authority and even responsibility because it is their *personal*

computer so they treat them with care and are always aware that these laptops are valuable resources of information and it contain their personal contents. He claims that laptops prepare students for the “life-beyond-school skills” such as collaboration, presentation, time management and problem solving skills that are needed at the workplace in the 21st century. Furthermore, they learn how to deal with computer repairs and become sometimes the school experts in troubleshooting helping both the teachers and the students.

Positive changes in the students’ attitudes towards school were verified by Jeroski (2003) in his report to evaluate the Wireless Writing Project, in addition to more motivation, good working habits, increased focus and less distraction among the students with laptops. Some studies found that students who used laptops more frequently demonstrated higher degree of self-satisfaction and self-reliance and were academically more talented; and other studies reported noticeable enhancement in student achievement, self-concept, self-esteem and motivation (CEO Forum, 2001).

The use of laptops in education noted to have some positive effects on students with special needs. In their study, Harris & Smith (2004) conducted a survey with the special education teachers within a laptop program and found that laptops are considered as an effective and valuable instructional tool for the students with physical, cognitive and emotional disabilities.

In their report Harris & Smith (2004) stated:

The laptops were credited with improving the engagement of students with disabilities with their school work; increasing their motivation and ability to work independently; and improving their class participation, interaction with other students, interaction with teachers, and class preparation. Special education teachers and parents indicated that the laptops also increased students’ personal organization. Another important finding of this study was that special education teachers perceived their special education students to have increased the quality and quantity of their writing. For many of these students, the laptops removed the

motor coordination challenge of writing with pen and pencil and allowed them to produce work that was easily edited and looked as good as the work of their non-disabled peers.

However, some researchers (Clark, 1994; Russell 1999; Ungerleider & Burns, 2002) argue that simply having access to technology (in all its forms, including laptops) does not change learning, so we cannot assume that providing laptops to students will simply change the way they think and learn. Clark (1994) argues that “A particular medium does not make a difference; it is the method of delivering the content that will influence learning”. Russell (1999) believes that technology can improve learning only when educators redesign the content to fit this technology. Moreover, Kozma (1994) stresses that we should stop asking whether technology effects learning in research studies, however the question should be: “in what ways can we use the capabilities of media to influence learning for particular students, tasks, and situations” (p. 18). In fact, some researchers (like Healy, 1998; and Russell, 1999) believe that technology can also have negative effects on and serious extortions to education. For example, computers can foster more isolation and technology dependencies than independent learners; and frustration with the failed equipment may replace the joy and motivation to learn (Healy, 1998). Healy (1998) in her book *“Failure To Connect: How Computers Affect Our Children’s Minds – for Better and Worse”* notes that using computers can create an imbalance between the needed basic literacy skills and the computer skills which were identified according to a survey with parents, teachers and leaders as the third most required skills for the twenty first century high school graduates after mathematics, reading and writing as first and good work habits as the second. Added to that the vision problems, back pain, hand and arm injuries that are increasing due to the use of computers in the classrooms (Healy, 1998). Sandholtz, Ringstaff & Dwyer (1997) reported that students with laptops faced some troubles with time management because they were busy making their projects visually attractive than spending more time on its content. Moreover, some

students found it difficult to adjust in the laptop environment and that lead to frustration. They also noted that there was loss of students' concentration in the classrooms.

2.3 Does using laptops improve the students' performance on tests?

Winnie Hu, a reporter at New York Times reported in May 2007 that some schools in Liverpool that previously adopted the laptop program are now dumping it because laptops are *educationally empty*. According to Hu (2007), the students of Liverpool High used the laptops to download pornography, for hacking, and exchanging answers during the tests. The school board President Mark Lawson and according to The New York Times reported: "After seven years, there was literally no evidence it had any impact on student achievement...none. ...the teachers were telling us there is a one-to-one relationship between the student and a laptop, the box gets in the way. It is a distraction to the educational process".

According to school officials, the laptops did not fit into lesson plans and did not affect the tests scores of the students who abused and misused the laptops. Parents were not happy and they have criticized the cost of the program for a long time. An example of disappointed father of a student at the Liverpool high school was Richard Ferrante who explained that he feel like ripped off every time he writes the check to pay the school taxes because his son used the laptop to become highly expert at the Super Mario Brothers video game (Hu, 2007).

Liverpool high was not alone in dropping the laptop program. The administrators of Pleasanton High School in Texas decided to end the school's laptop-per-student effort because they could not monitor what students were doing with laptops outside the school and instead laptops are put on carts in classrooms rather than giving each student a laptop to take home (Stern, 2007). At Matoaca High School in Virginia, the students never used the notebooks for educational purposes and there were no signs of academic gains of using the laptops causing the school to prepare eight computer labs to replace the five-year-old laptop program. Because more efforts were being given to repair the laptops than to train the

teachers on using them, Northfield Mount Hermon School at Massachusetts decided to eliminate the laptop program in 2002 (Stern, 2007).

According to Carrie Fried (2008) there has been recently recoil against using laptops in the classrooms. More and more teachers are prohibiting the use of laptops due to their concerns about its negative impact on the students learning and many are raising concerns about the distraction it causes in the class. Fishman (2009) reported that some professors at the University of Colorado were frustrated by the students who use the laptops for non-educational purposes like updating the Facebook pages, and revealed that it was badly affecting the students' grades. One professor noted that after the first test, 17 of her students who were using the laptops more frequently in her classes scored 11 percent worse than the other students who did not use the laptops much. Furthermore, the press reported that several professors at the Universities of Michigan and Wisconsin, Harvard, Florida International, and Georgetown Universities had ordered laptop-free zones and were pushing for banning the use of laptops in their classes (Fishman, 2009; Foster 2008).

Research on cognitive science reveals that laptop use could interfere with the process of learning. Humans have selective and limited abilities to process information and pay attention especially in the presence of too many sources of information like the laptops that are considered as sources of overload and distraction (Posner 1982; Roda & Thomas 2006, cited in Fried, 2008). Research studies on the cognitive interference show that "new information such as popup messages, appearing while a subject is performing a primary task slows performance speed and increases errors. Because of the vertical orientation of laptops, they also pose more distraction to fellow students than traditional note-books. Thus, the cognitive interference posed by laptops could spread from users to those seated nearby" (cited in Fried, 2008). Several research studies supported this assumption and the results revealed that laptops are the main reason behind the students lower test scores. A study by

Fried (2008) with one hundred thirty seven university students from the freshmen to senior years revealed that students were using the laptops during lectures for things other than taking notes thus their attention and understanding ability during the lectures was negatively affected which sequentially resulted lower achievement scores. Another study by Barkhuus (2005) showed that students with laptops used it to surf the internet, communicate with their peers and write their assignments during the lectures. The Texas Center for Educational Research conducted a study that compares the state test scores of the students of 21 schools with laptops and the students of 21 other schools without laptops and found no overall difference (Hu, 2007, cited in Holcomb, 2009). Similarly, no evidence was found that laptops increased the scores in state tests of the students of ten schools in California and Maine from 2003 to 2005 (Warschauer, 2006, cited in Holcomb, 2009).

Apparently, there was a rush in adopting laptop programs especially in higher education and recently there has been a call for doing more and more research on the effects of laptops on learning in the classrooms. Melerdiercks (2005) claimed that “in a rush to adopt laptops as the tool-do-jour in higher education, research on the impact of laptops on learning has been neglected (cited in Fried, 2008).

The bright story of the success of the 1-1 initiatives did not include all schools and universities and a lot are arguing that there is no point of following such programs. However, many others argue that despite of all of all the drawbacks students should not be deprived of the possible gains. They also add that parents should not worry because inappropriate websites are part of everyday life and it is hard to avoid them, and even if students do not intentionally search for them, they will see it in normal emails or when using search engines (Rockman, 2007). Rockman (2007) insists that “young people have been able to find what they want to find well before the development of the personal computer, so why would we expect this generation to be different?” and that “overprotection and rigid, absolute rules will

lead to creative problem solving. If students want to, they will find a way”. When applying a laptop program, some flexibility and freedom is needed besides reasonable constraints. According to Rackman (2007) students in a laptop program are using their *personal* laptops and some personal use must be expected, especially if they take it home and have 24/7 access to internet and what is important is that students know how to differentiate between what is acceptable and what is not suitable in the classrooms and the school.

As a conclusion, before implemented a 1-to-1 initiative school or university administrators and much weigh the advantages and the disadvantages of such action. They should pick one of the two options: either to look at the empty part of the cup and choose to step away from the program and deprive the students from the possible gains, or look at the full part of the same cup and choose to follow the program taking into consideration the drawbacks of the project and thus start searching for creative ways to protect the students from the misuse of the machines. According to Rockman (2003) administrators will be definitely disappointed if they wait for gains in specific test scores as a return on laptops investments and he adds that “laptops may not be the direct tools for teaching and learning what is on the tests, but they are associated with learning strategies that show up on tests. Computers do not provide content, they offer the tools to access, manipulate, and organize content....how students use technology-for writing, online research, organizing information-appears more closely tied to [the] 21st century skills than to standardized tests”.

2.4 Students’ and teachers attitudes towards using laptops in classrooms

Several studies indicate that both the teachers and the students’ attitudes towards computers have a huge influence on the success of computers integration in education (Al Jabri & Al Khalidi, 1997). Liaw (2002) states that “in general, no matter how sophisticated and how capable the technology, its effective implementation depends upon users having positive

attitude towards it". Attitudes towards technology and going deep to understand why people accept and discard technology is one of the most challenging topics in the field of technology research (Davis et al., 1989, cited in Liaw 2002). According to research studies, the successful application and implementation of computer use in education depends heavily on the students' attitudes and acceptance of technology (Venkatesh et al, 2002, cited in Manochehri & Sharif, 2010). As computers and specifically laptops become integral part of education in all levels, it is important for educators to become aware of the students reaction towards it. Research suggests that if negative attitudes towards computers exist, the utilization of it in a learning environment might not succeed (Manochehri & Sharif, 2010).

Attitude is defined by Gibson et al as " a positive or negative feeling or mental state of readiness, learned and organized through experience, that exerts specific influence on a person's response to people, object and situation" (Gibson et al 1960, cited in Al- Jabri & Al-Khaldi, 1997). It was suggested by Triandis (1971, cited in Liaw, 2002) that attitude has three components: the affective, the cognitive and the behavioral. Examples of effective component of attitude are the statements of likes and dislikes that reveal the persons feelings or emotions. The statements of beliefs are examples of the cognitive component of attitudes while what a person does or intends to do is the behavioral component. An attitude towards computers does not have a single definition and it has been defined in more than 14 different ways in the literature (Triandis 1971, cited in Laiw, 2002).

Research studies suggest many benefits of using laptops in higher education and indicate that "higher education students who use laptop technologies in class have reported greater satisfaction with their overall academic experiences ... [and] that the laptop helped them focus better, follow in-class presentations, and take advantage of academic resources on the web" (kay & Lauricella, 2010). Moreover, it was noted by other studies that students favor taking classes in which the instructor allows them to use their laptops and they also believe

that using laptops makes learning “easier” (Mitra & Steffensmeier, 2000). Another study conducted by Isman et al (2004) to investigate the perceptions towards computers of undergraduate and graduate students at a university in Cyprus showed that students perceive computers as important in their life and they had positive attitudes towards it help in organizing their life efficiently.

Studies in the field of educational technology indicate that the attitudes of the teachers towards technology also play an important role in utilizing it in to the educational settings. Two main conditions must be satisfied to achieve effective integration of technology in to the classrooms; the teachers must have positive attitudes towards educational technology and should be very well trained on using it (Dawson et al, 2008, cited in Inan & Lowther 2010). Recent studies indicate that teachers beliefs about and perceptions of technology influence the amount of computer use in the classrooms (Ertmer, 2005, cited in Inan & Lowther 2010).

2.5 Mathematics and technology

The use of technology in mathematics teaching and learning is highly emphasized by the Principles and Standards for School Mathematics (NCTM, 2000). The Technology Principle states that “Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning”. Although using technology in teaching and learning mathematics has been proved to have positive effects on the students' attitudes towards mathematics and their tests scores (Ozel, Yetkiner & Capraro, 2008), research studies reveal that technology is being used less by mathematics teachers when compared to teachers of other subjects like languages (Lemke & Martine, 2004, cited in Holcomb, 2009).

Technology in mathematics education has various forms including: calculators, interactive whiteboards, immediate response devices (IRDs), web-based applications and computers

including desktops, laptops, personal digital assistants (PDA's) and hand-held computers. Computers are becoming more popular and integrated into mathematics classes especially with spread of the portable versions like the laptops (Ozel, Yetkiner & Capraro, 2008). The advantage of having laptops in mathematics classrooms lies in its size, mobility, portability and the ability to include a calculator, calendar, clock, and software such as word processing and spreadsheets, audio and video recording software, survey response recording, and web-based applications (Ozel, Yetkiner & Capraro, 2008).

Research studies on the effects of using technology in mathematics classroom suggest that it improves the students' attitudes towards learning the subject and increases their understanding and also improves their proficiency in mathematics (e.g. Weaver, 2000). In their review of the different technologies used for mathematics teaching and learning, Ozel, Yetkiner & Capraro (2008) state that “ Interactive mathematics computer programs such as Geometer's Sketchpad and virtual modeling and visualization tools provide students with dynamic multiple representations and support their understanding as they interact with concept in a variety of ways. In addition, computers offer students immediate access to the web, where they can find additional resources and use interactive websites to investigate mathematical concepts”. Some research studies have shown the use of computers in mathematics lessons has helped students to build confidence in their ability to do mathematics, promoted their higher order thinking skills, and increased their reasoning, analysis and problem solving skills (e.g. Kersaint, 2007; Kerrigan, 2002).

Moreover, when students have laptops with internet connection they have access the Web-based practice and assessments that gives immediate feedback and scoring, and they can use the interactive sites that help in investigating various mathematical concepts (Ozel, Yetkiner & Capraro, 2008). However, all of these gains and positive effects cannot be achieved

without the proper use of technology and unfortunately many teachers failed and still do not know how to integrate technology into mathematics instruction (Weaver, 2000). In fact, teachers in many schools did not have the proper professional developments and were not provided with “technology-based curriculum materials” and therefore the available technology “lay unused” (Muir, 2007; cited in Ozel, Yetkiner & Capraro, 2008).

CHAPTER 3

UAE AND THE 1- to-1 INITIATIVES

Today, The United Arab Emirates enjoys a comparable level of modern technology and infrastructure to western countries. According to the Global Information Technology Report, UAE is the 27th globally in terms of internet access in schools and the government of UAE is placed at the 5th highest rank globally in terms of its prioritization of Information and communication technology (GITR, 2009). In UAE there are approximately more than 1,150,000 active users of the internet and most the organizations in both the public and the privet sectors offer access to the World Wide Web (GITR, 2009).

The Ministry of Education of the United Arab Emirates constantly works to ensure that the programs developed in its schools meet the terms of the international standards; mainly it is focusing on introducing ICT at all levels. One of its main goals is to provide computers at the ratio of one-to-ten in kindergarten, one-to-five in primary schools, one-to-two in high schools and one-to-one in universities (UAE Interact, 2010). In his welcoming speech at the “Crossroads of the New Millennium” conference in 2000, HE Sheikh Nahyan Mabarak Al Nahyan, Chancellor of the Higher Colleges of Technology; stressed at the big influence technology has on the way we live and learn. He revealed:

Today, technological change is not only rapid but spasmodic. It overwhelms us with unforeseen possibilities, especially in the field of education. ...Indeed, these technological forces are changing forever the way we learn and the way we work.... It is now abundantly clear that if educational institutions do not keep up with this ever-expanding information technology, they will cease to survive as legitimate centers of learning. ... Our challenge as educators then will be to devise more effective tests and measurement instruments by using the latest educational technology both inside and outside the classroom.

The Dubai e-government was launched in 2000 aiming at providing 75% of its services online by 2005. As a result, and to ensure that UAE citizens are IT literate; HH Sheikh Mohammed Bin Rashid Al Maktoum launched the “IT Education Project” (ITEP) that included:

- IT training to 10th and 11th grade students: more than 52000 students were trained using the 20 labs that were constructed in Dubai and Abou Dhabi secondary schools.
- IT training for Dubai Police department: more than 3558 policemen benefited from the program that took place at the 5 labs that were constructed at the Dubai Police Academy.
- The ICDL initiative: 60 hours of training to equip the individuals with the basic computer skills to be ready for the test.
- The i-teach program for teachers: a professional development program for teachers that leads to a diploma in teaching with ICT from the University of Cambridge (DTWICT). (ITEP, 2005).

And to push for more use of technology in education, the Ministry of Education in 2008 signed an agreement with Etisalat, which is one of the biggest telecommunication services providers in UAE, to provide the public schools with “ IP/MPLS internet connectivity and technical support services” (MoE, 2008). Dr. Hanif Hassan, the UAE Minister of Education at that time, revealed at the occasion of signing the agreement that “such facilities will definitely encourage our students to develop skills and achieve the best education possible and this agreement will also enable the UAE to become a regional educational hub” (MoE, 2008).

A considerable number of schools and universities at UAE are implementing technology in teaching and learning. Al Mawakeb School initiated its campaign “Notebooks for Books” in cooperation with Intel at the end of 2003 to be the first school in UAE to use laptops as replacements for the hard copy books and teaching materials. About 600 students of grade 11 and 12 used the laptops to download the course material instead of using the exercise books. The attendance was taken digitally and the classrooms were equipped with interactive white boards instead of the traditional blackboard (Press Release, 2006). According to a report by Intel Corporation, the integration of technology every day at the classrooms of Al Mawakeb School enhanced the students ICT skills, increased the students’ attention level throughout lessons, significantly improved the students’ academic performances, and finally saved time for the teachers to prepare the lessons (Intel, 2006). However, one should not ignore the fact that the report was produced by the special interest group, Intel itself; the partner of the school campaign so these findings should be interpreted with caution.

The Dubai Women’s College started its laptop program in 2000 by offering ThinkPad notebooks to about 600 students, aiming at providing them with more flexibility with their work, technical skills and knowledge. This initiative were afterwards extended to the other members of the Higher Colleges of Technology (HCT) to include more than 7000 ThinkPad T410 and ThinkPad X201 Tablet machines in 2010, when HCT and Lenovo MEEP(Middle East, Egypt and Pakistan) signed a new agreement. The HCT Vice Chancellor Dr. Tayeb Kamali revealed at this occasion: “At HCT our priority is to insure our students get the best education. Providing students with these laptops will support them with the best IT technology; provide them with the technical skills to operate in an increasingly complex technological world” (Press Release, October 2010)

In 2009 The Institute of Applied Technology, which is a large institute with five campuses in five different emirates; has signed with Apple and Intel a Memorandum of Understanding to work together on eLearning and training. Students and teachers at IAT were provided with 3000 Apple Mac notebooks powered by Intel Core 2 Duo processors (www.iat.ac.ae). According to Dr. Abdullatif Al Shami the director General of IAT “This initiative is extremely important for the future of education in the UAE. At IAT we strive to provide our students with a strong foundation for learning and believe that 1:1 computing is an excellent platform to help students realize their full potential” (AMEinfo, 2010).

As a conclusion, in UAE as in the other countries of the western region the schools and universities are recently directed towards more use of technology in education and particularly more implementation of 1-to-1 computing. However, there is significantly a small amount of studies to evaluate these initiatives in UAE. More research studies are needed to evaluate the effectiveness of such initiatives with the Emirati students at all levels of education. Moreover, more studies are required to investigate the experiences of those students with laptops mainly at high levels of education specially that the 1-to-1 computing programs are only recently followed by the schools and universities in UAE which means that students who are using these laptops at the universities now are not used to these technologies in their schools and are new to dealing with it at least within the context of learning.

CHAPTER 4

THE PRESENT STUDY

4.1 Student demographics and educational background

Fifty-eight emirate female students enrolled in the foundation program (two years program where students who get low CEPA scores in math and English are given intensive courses to be able to join the B.Sc. program later) in a college in United Arab Emirates participated in this study. The students' age ranged between 17 and 20 years. Twenty-three of them (39.65%) did not have laptops before coming to the college and it was their first time to deal with it when the college provided them with the devices at the beginning of the academic year 2009-2010. The students have used the laptops for two semesters and this study was conducted at the end of the second semester. Most of the students are coming from government's schools (according to the college documentation) and their level of English is in general weak (all the students in foundation level are of ILTES scores less than 5).

It should be noted that despite of the heavy developments, the secondary schooling system at the United Arab Emirates is very traditional where teachers lead the classes most of the time (Saunders and Quirke, 2002). According to the Education Vision2020 document, the government school curricula are characterized by "repetition, redundancy and weak readability" and are "cognitive in nature". They do not provide learners of opportunities that promote self-learning, exploration and creativity because they still have not been developed with respect to new educational approach of the country despite of the continues reviewing and updating. They only provide learning experiences that indorse the skills of memorization and recitation thus, "learners have become passive in what they take and do not give, memorize and don't think" (Makrakis, 2005, p. 4). Therefore, students who participated in this study were in general used to teacher-centered learning environments and thus suddenly

putting laptops in their hands to use for learning in the classroom was a total new educational experience to them.

4.2 Teachers' demographics

The three teachers included in the current study are three female teachers of mathematics working at the foundation level. Each of the teachers has a bachelor degree in mathematics and two of them have master's degree in education. The three of them have more than six years of teaching experience, and worked a minimum period of two years in the college. The teachers got the ICDL (International Computer Driving License) and were provided with personal laptops the moment they joined the college. All the teachers have used various technologies in teaching mathematics for more than three years including smart boards and software like excel and access. None of them had an experience in dealing with students using laptops during the class time

4.3 How does the laptop program work?

The students at the foundation level were required to buy a Toshiba Tecra M10 Laptop that was provided by the college. The specifications of the laptop are summarized in table1. The laptop costs 5000 Dirhams and the students had to pay during the first two weeks of the semester. Students who could not pay were given forms to fill to get the amount from charity organizations that usually provide such help. During the first two weeks, the computer teachers were responsible for introducing the basics of using the laptops to the students. The students were provided with handouts explaining how to use laptops, its capabilities, and to how protect it from possible damages.

Table 1: The Toshiba Tecra M10 Laptop specification

2.8GHz CORE2 DUO T9600 Processor
4GB 800MHz RAM
250GB SATA 5400RPM HDD
14" WXGA+ TFT Screen
NVidia Quado 150M VGA
Realtec HD Audio
TEAC DV-W28S-RT DVD Writer
Intel 82567LM Gigabit Ethernet
Intel 5100 W-LAN 802.11A/G/N
Bluetooth
RECOH SD/MMC adapter
56K Modem
Chicony Web camera
3 USB Ports
1 eSata/USB Port
IEEE 1394 FireWire Port
Authen Tec AES 1610 Finger print reader

The first few lessons of the computer course explained how to operate and navigate the laptop, and how to use the different drives at the college network (the S-drive were the students save their files during the year and the G-drive were teachers keep the teaching material for the students to review at any time). The students also were introduced to the college portal, where they can find their profiles to check their attendance and achievement progress and check their schedules and assessments plans for each course. Each student had a user name and a password to use to enter the college portal and for security reasons. They were also trained on using e-mails and outlook for communication purposes and the teachers explained the rules and the expectations around using their laptops in the classrooms.

Finally, the content teachers including the mathematics teachers introduced the Black Board Vista (BBV) to their students and explained how to use it for each course.

Students were expected to bring their laptops every day to the class for each subject during the whole academic year. The teachers were asked to start modifying their teaching strategies to fit the use of laptop in the classrooms to reach a target of 50- minute use of laptops in each class. The classrooms were refurbished and each classroom (Figure 1) contained the following items:

- Smart board and a projector
- White board
- The teacher's desk with a computer.
- Two computers to be used when students forget their laptops or face some technical problems placed at the corner.
- A printer
- The student's tables, rectangular and placed in groups of four.
- Power sockets places on the floor.

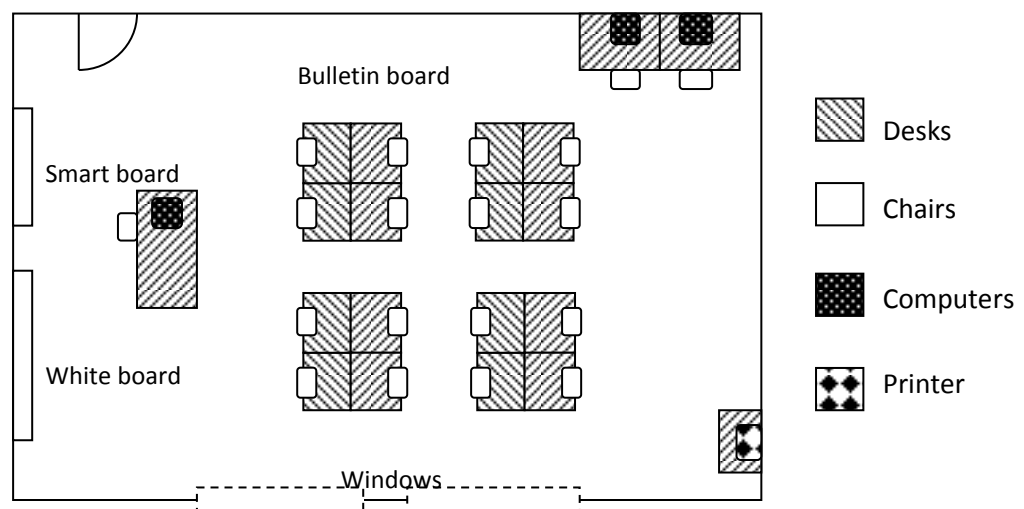


Figure 1: The layout of each classroom

4.3.1 Blackboard Vista

One of the main web-based software's that are used in the college is the Blackboard Vista (BBV). Blackboard Vista is a Learning Management System (LMS) or some time called Course Management System that allows the delivery of a course over the internet. The typical features of such a system are:

- Home page: which contains the list of courses, syllabus and pre-requisites and teaching materials designed to deliver the course online (Figure 2).
- Self-assessments: quizzes in which students can use to practice on certain topics. The teacher can set the properties of the tests to give direct feedback after entering the answers.
- Lessons tools: including the content and quizzes or tests (Figure 3) that can be set with passwords and time limits for security issues.
- Communication tools: including email, chat, forums and teleconferencing.
- Student's tools: including the grade book and bookmarks and so on. (EDUTECH WIKI, 2011).

As part of the laptop program implemented by the college, all teachers including teachers of mathematics were required to plan their courses using blackboard Vista and design the assessments to be delivered online through the system. All students were provided with passwords and usernames access to BBV as learners and all mathematics teachers were given access as teachers and designers of the course. Teachers started attended professional development sessions designed by the college to learn how to plan a course on BBV and the process of building the course was ongoing though the academic year.

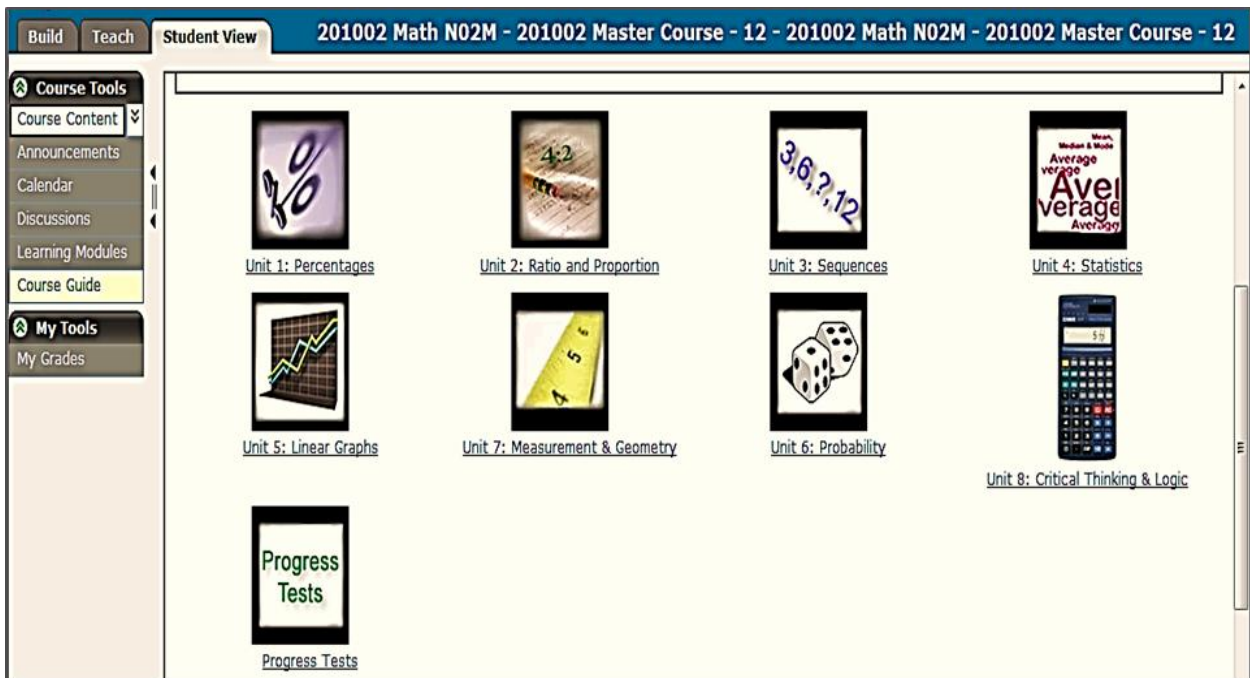


Figure 2: Home page with the course content viewed by the students and designed by teachers

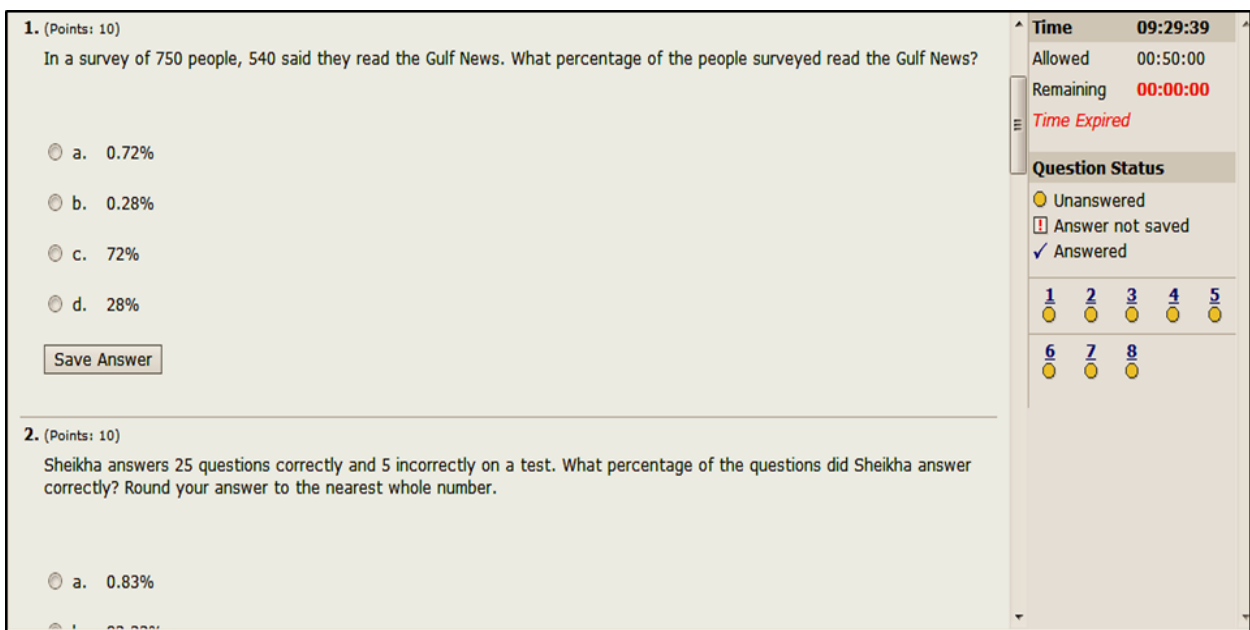


Figure 3: A quiz that was designed for the students to access through Blackboard Vista

4.3.2 The math course

The teachers were delivering a foundation mathematics course that was originally designed to review some of the basic concepts of mathematics that are usually covered in high schools.

The course was made of eight modules with the main learning objectives:

- Percentages: Use percentages to quantify and describe change.
- Ration and proportions: Apply the concepts of ratio and proportion to various types of problems such as reading maps and converting currencies.
- Sequences: Demonstrate an understanding of sequences (geometric and arithmetic)
- Statistics: Calculate mean, median, mode from a data set, and understand and discuss their significance in real life situations.
- Linear graphs: Identify the components of linear equations that are used to create graphs of those equations.
- Measurements and geometry: Apply the concepts of perimeter and area of simple 2-D shapes, and surface area and volume of simple 3-D shapes, to solve real life problems.
- Critical thinking and logic: Explore and apply critical thinking by using reasoning to build problem solving skills.

The modules were intended to fit as a prerequisite for the other mathematics courses delivered at later stages in the college and so was designed by a group of mathematics teacher with along working experience in the college and students photocopies were made in the college production center. A typical lesson would include: definitions of the main concepts, examples with clear and direct instructions and practice exercises at the end. The book was

not designed to fit any kind of technology and did not include any extra resources, CD or online links.

4.4 Data collection

“Good research practice obligates the researcher to triangulate, that is, to use multiple methods, data sources, and researchers to enhance the validity of research findings” (Mathison, 1988). Triangulation is a strategy that is typically used to improve the validity of research findings and it considerably can increase its credibility (Johnson & Christensen, 2008). The use of multiple research methods in one study is known as methodological triangulation in which its rationale is explained by Denzin (1978) as “that the flows of one method are often the strength of another, and by combining methods, observer can achieve the best of each while overcoming their unique deficiencies” (cited in Mathison, 1988). So, for more validity both qualitative and quantitative data were collected from both the students (58 students) and the teachers (3 mathematics teachers) throughout the second semester of the academic 2009-2010. Data collection methods included first student questionnaires and teacher questionnaires at the middle of the second semester. And then for more clarification and elaboration the author conducted student focus groups at the end of the semester, classroom observations (during the second semester), and teacher interviews at the end.

Student Questionnaires: a questionnaire was designed to collect both quantitative and qualitative data for the study. It is made of three parts:

- 1) *General questions:* five short questions about the use of laptops in general, designed to collect background information for the study.
- 2) *How are laptops being used in mathematics classroom:* eight questions about the use of laptops during mathematics classrooms to understand the student’s perceptions about the advantages and disadvantages of this use.

- 3) *Student's attitudes towards using the laptops during mathematics classes: a 5-point Likert scale table made of 16-items, for measuring the student's attitude towards the use of the laptops to learn mathematics. Each item is a short statement written by the researcher about using laptops to learn mathematics, and students are asked to choose one of the five choices: Strongly Agree (SD), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD); in order to evaluate the students' level of agreement or disagreement to that statement.*

The cover page of the questionnaire explains its purpose and promises that no personal information is required and all the information will remain confidential. A total of 58 students completed the questionnaire during the month of May 2010. Taking into account the educational level, the age and the cultural back ground of the participants (as discussed earlier at the students demographics section), the questionnaire questions were written twice, first in English and then in Arabic to assure that the students understand what is needed from each question. The researcher used a simple and clear question items to make the students' task of filling out the questionnaire easy and less confusing.

Before the questionnaire was administered, it was reviewed by a bilingual English teacher for proof reading and to make sure that the translation is correct. Later, the questionnaire was validated by conducting a tryout session with a group of 5 students to fill it to understand their interpretations and provide feedback regarding the language level; the clarity of both the directions and questions, and the time needed for fill it all. The necessary modifications were made after and the final version was used (Appendix A).

Finally, the questionnaires were filled in small groups' settings where the author read the items to the students and provided the necessary explanations. All the questionnaires were completed and returned back to the author directly at the same session.

Teacher Questionnaires: a questionnaire that was designed for two purposes. The first is to collect demographic information about the teachers including years of experience, educational background, subject specialization, and the background of ICT knowledge and training. The second is to accumulate data regarding the frequency of the use of laptops in the classrooms, advantages and disadvantages towards the laptop use for mathematics teaching and learning, and obstacles of using it. It is a short questionnaire that is made of two parts of a total of eight questions (Appendix B).

Classroom observations: three laptop classrooms taught by the three mathematics teachers were chosen randomly and were observed on three different occasions each through the second semester. All observations were conducted by the researcher of the current study and lasted each for 50 minutes. The researcher designed and used an observation tool that was based on the observation tool used at Maui Laptop Program evaluation study conducted by Rockman et al (2004) that was originally based on an instrument created by Wetzel and Timms (2003) (cited in Rockman et al, 2004). The original instrument used by Rockman et al (2004) was reviewed and modified by the researcher to fit the purposes of the current study.

The observation tool was made of four parts as follows:

- 1) *Timed interval observations*: this part was made of a long table that is divided into 5-minute intervals and covers five categories of focus (a) class organization; (b) role of the teacher; (c) teacher's use of the laptop; (d) students' use of the laptop; and (e) purposes of the students' use of the laptop in learning math.
- 2) *Other observation notes*: a page that is made for taking notes about the number of the students in the class, the flow of the lesson, the teacher's role, the students' use of technology in general and their level of engagement during the lesson and their level of technical skills. This part was designed for more elaboration and clarification of the results of the first part of the tool.

- 3) *The classroom layout*: an empty page to draw a simple sketch that represents the setup of the classroom. The observer used arrows to represent the position of the teacher relative to the students and the interaction between each other and to indicate changes in the arrangement in case it happened.
- 4) *The teacher interview questions*: this section of the observation tool contains the questions to be used when interviewing the teacher after the observation is made. It contains questions about the observed lesson and the teacher's general opinions about the students' laptop use in the classroom for learning mathematics.

After the researcher has designed the observation tool, the instrument was used it in one of the mathematics classes to check its usefulness and effectiveness in the classroom observations. Necessary modifications were made afterwards and the instrument (Appendix C) was used nine times in three different classrooms.

One extra observation was made while all the foundation students were doing a mock exam at the end of the semester on blackboard vista at the multipurpose hall. The researcher was one of the invigilators and took general notes during the exam.

Student Focus Groups: a total of seven focus groups were conducted for additional qualitative data for the study with 48 students only. Not all of the 58 students participated for two reasons: (1) some were absent at the days of conducting the focus groups and (2) some of the girls refused to participate to due to cultural constrains since all the focus groups were audio-taped. The number of students in each group ranged from 6 to 8 and each focus group lasted approximately from 20 to 35 minutes. Five main topics were targeted during the focus groups: (a) student general attitude about using the laptop during mathematics lessons, (b) the technical problems faced during the use, (c) the advantages and the disadvantages of using the laptops, (d) the effectiveness of using the laptops for mathematics learning and

assessments, (e) student suggestions for better use of laptops during mathematics classes. All students were encouraged to participate and the researcher tried to allow enough time for each question to be answered by them.

Teacher interviews: three interviews were made with the three math teachers, right after the two classroom observations for each class were made. The interviews were audio taped and two main topics were targeted through the questions: (1) the advantages and the disadvantages of using the laptops in mathematics classes and (2) the teacher's general attitudes about it.

CHATER 5

DATA ANALYSIS

5.1 Focus groups

The audio recordings of the student focus groups were first transcribed and translated to English and then were analyzed using segmenting and coding, and finally a category table was developed.

Segmenting: each focus group transcript was read line by line and the author tried to locate meaningful segments or parts. Then the text was divided into units (parts) that have meanings and the author thought that it should be documented. The units included single words, single sentences, two or more sentences and sometimes short paragraphs.

Coding: the author assigned codes or category names to identify the units obtained. The author started with preexisting codes that were developed at the beginning of the study. However, new categories were generated during the process of segmenting and were added to the previous ones. Finally, the process ended up with seven categories as follows: (1) attitudes towards using laptops in mathematics classes, (2) technical problems faced during the use of laptops, (3) laptops and assessments, (4) suggestions for better future use of laptops in learning mathematics, (5) laptops as a distractor, (6) paper and pencil over the laptop use, (7) some benefits. The final coding scheme was applied in all the transcripts of the seven focus groups.

Category table: in an attempt to reduce data and seek meanings the author created a table that shows the seven categories with the corresponding related units obtained from segmenting the transcripts of each focus group. (Appendix D)

5.2 Students' Questionnaires

Data analysis of part 1 and part 2: All data collected from part 1 and part 2 of the questionnaires were summarized to make it easier for the author to retrieve information whenever needed in later stages of the study. The data will be presented in the following chapter of the study.

Data analysis of part 3: Using the Microsoft Excel, the data collected through the third part of questionnaires (students' attitudes) were coded and interpreted in terms of percentage and mean scores. Each of the five responses was assigned a scale value as follows:

Level of agreement	Scale value assigned
Strongly disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly agree	5

To calculate the mean score of each item the following formula was used:

$$\text{mean score} = \frac{(a * 1) + (b * 2) + (c * 3) + (d * 4) + (e * 5)}{n}$$

Where a = frequency of strongly disagree, b = frequency of disagree, c = frequency of neutral, d =frequency of agree, e =strongly agree and n = the total number of students who responded to that specific item.

Excel was also used to calculate the standard deviation of each item to be included in the table summary of the results.

5.3 Classroom observations

The classroom observations were analyzed first class by class and then were combined together to form the final results of all the observations. The timed interval observations were first analyzed for each category for each class and the results were presented in form of

percentages. At the end a table was formed to summarize the percentages of each category in all the observations (Table 2). Some of the data was displayed into chart forms for more clarity and to retrieve information easily. Data from the observation notes were collected to elaborate on the results for each category.

5.4 Teachers' interviews and questionnaires

Data from teachers' interviews were first transcribed (Appendix F) and then repeatedly read by the author who identified excerpts that discuss the practices during mathematics classes and teachers attitudes towards the issue. Excerpts on teachers' attitudes included statements on the effectiveness of using laptops by the students in learning mathematics, its advantages and disadvantages. Excerpts related to practices included statements that on the different ways the laptops were being used by the students to learn mathematics and for assessments. After the analysis of each teacher was completed, data was combined with information collected by the teacher questionnaires to come up with the final results.

CHAPTER 6

RESULTS

6.1 The use of laptops in mathematics classrooms

Research question 1: In what ways were the laptops utilized in mathematics classrooms during a period of two semesters (one year 2009-2010) by both the students and the teachers?

Mathematics teaching and learning with students using the laptops in the classroom was one particular focus of this study. The researcher aimed at investigating and exploring the different ways laptops were being utilized by both the students and teachers in mathematics classes. For this purpose, data from the classrooms observations, student questionnaires, and the focus groups, were combined together and triangulated for more valid results. Data collected by the classroom observation tool in nine classes were reviewed and then summarized in table 2.

Students' use of laptops

Students used their laptops in all of the nine observed classes. All the students had their laptops except one girl who explained that the laptop was sent to IT department to solve some technical problems. In two classes students took out their laptops immediately after entering the classroom and were asked to use it solve some exercises on Blackboard vista (BBV) related to a previous explained lesson. In the other seven classrooms students were asked to keep their laptops unopened until the teacher had asked them to use it later after the explanation of the lesson was done. In two of these seven classes, students used their laptops at the last ten minutes of the class.

Table 2

Class Observations Results - Time Allocated for Each Category in Percent.

Categories of focus	Mean %*
1. Class Organization	
Individual students working alone	33
Pairs of students	10
Small groups (3+ students)	-
Listening to the teacher	57
2. What is the teacher's role?	
Directing	54
Interactive direction whole group	10
Modeling whole group	-
Facilitating/Coaching	23
Managing behavior or material	13
3. Teacher's use of laptop	
To present information	37
To model a skill or strategy to large group	7
For grading, attendance, or material preparation	10
To retrieve information	-
Other (write down)	-
Not using	46
4. Student's use of laptop	
To retrieve information	-
For communication purposes	-
Use productivity tools	-
Use of specific software for math	34
Other (like not for educational purposes)	15
Not using	51
5. Purposes of the student's use of laptop in learning math/out of the time laptops used by the students to learn math	
To learn a new skill, strategy, fact, theory...	-
To practice on a given topic	80
For assessment purposes (online quizzes and tests)	20
Searching for a real life application on the given topic	-
Other (write down)	-

*All percentages are rounded to whole numbers

Data collected by the students' questionnaires indicated that the laptops were in general used in mathematics classes for about half of the time of the class (Figure 4).

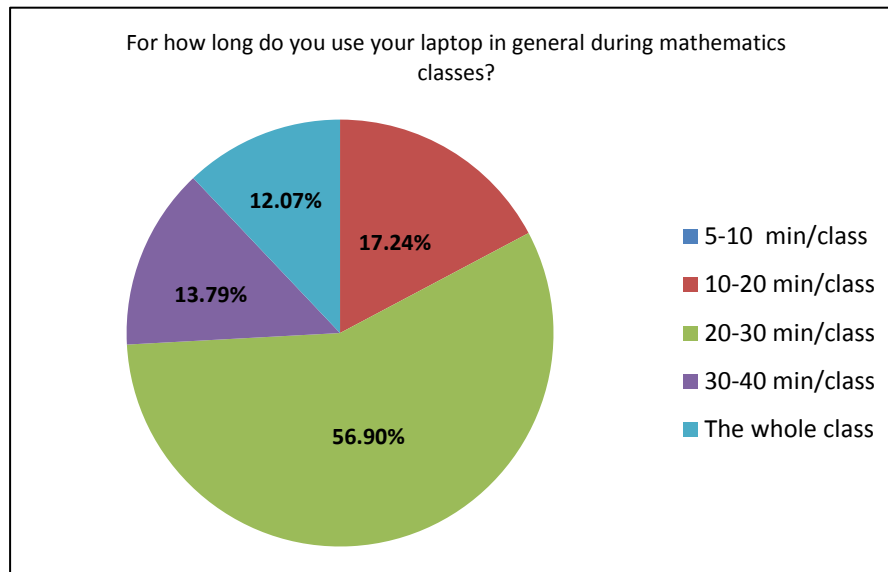


Figure 4: Students' choices on the questionnaire question about the duration of using the laptop in mathematics classrooms.

More than half of the students (33 students) indicated that they used the laptop for almost 30 to 40 minutes which represents more than half of the mathematics class duration. At the same time, data from classroom observations (Table 2, category 4) revealed that the students did not use their laptops in average for almost 51% of the duration of the class.

Across all observed classes, students were setting in groups; however they were mostly listening to the teacher for about 57 % of the class time and working individually for 33% of the class time (Table 2, category 1). When they used the laptop, the main purpose for using it was to solve exercises on BBV for practice (Table 2, category 5). In fact, the students spent 80% of the time when they used the laptops in mathematics sessions to solve the practice exercises and quizzes on BBV that provide direct feedback to check their understanding of the lessons.

Students reported by the questionnaires that they had also used their laptops for a range of activities including (with frequency of students answers in brackets):

- Solving exercises on the college portal (online practice exercises) (19)
- Solve exercises on the BBV for each module (49)
- Sending the homework and the projects by email to the teacher (10)
- Printing the worksheets and the revision sheets (21)
- Typing the projects (5)
- Using the email to communicate with each other and the teacher (8)
- Checking their marks on the college portal (53)
- Reviewing the PowerPoint presentations of the lessons (18)
- Doing some online tests and quizzes on the BBV (27)
- Using the calculator of the laptop (6)

According to the classroom observations, students did not use their laptops in mathematics classes to search for information by using internet search engines or websites and also did not use productivity tools like word, spreadsheets or Geometer's Sketchpad.

In general, the level of the students' technical skills was quite good. However, some students were very dependent on the teachers to solve the technical problems they faced in the classroom especially with issues related to internet connections. It was noted that students had some difficulties in using the keyboard to type in English since they were more skillful in typing in Arabic as one of the students explained: "we use the Arabic language for Facebook and chatting, if we use the Arabic language for the laptop at the college we will find it easier".

Teachers' role in the class and use of laptop

Teachers spent on average about half of the class time (54% of the observed time) directing the lessons. They were providing explanations and information on the board and were doing most or all of the talking. For about 10% of the class time teachers used the interactive direction approach with the students, i.e. they asked questions, students replied and later they evaluate the students' answers and give feedback (Table 2, category 2). When students were asked to use their laptops, teachers were acting as facilitators i.e. moved around, checked the students work on BBV, explained and gave clarifications and provided suggestions. For almost half of the class time (46% of the class time) teachers did not use their own laptops. When teachers were using their laptops, they were mostly presenting the lessons to the students (37% of the time of use) by projecting the information to the Smart Boards. The three teachers had a softcopy of the math book in their laptops, and most of the time they have projected the book itself on the board to explain the concepts and work out the exercises with the students who were writing on their hard copies at the same time. For 10% of the class time, teachers used their laptops to take attendance, to find already prepared worksheets and print papers or to edit BBV course content.

Students' Engagement

In the nine classroom observations, the mathematics teachers asked the students to put the monitors down and listen to the explanation of the lesson. However, some of the students were observed in some of the classes using their laptops despite of the teachers' request of closing it. One girl in one observed classroom seemed to be engaged in chatting, she was not paying attention and was typing repetitively while smiling, without looking at the board. Two girls in another classroom were observed working on Facebook and a website for downloading music. Actually, findings from the focus groups indicate that some students

were not using the laptops in the classrooms for educational purposes. A group of the girls revealed that laptops were distracting some of the students which negatively affected their performance in mathematics. A girl explained: “The girls always open the messenger during the class time ...the teacher does not know ... they have their ways to hide it “and another girl added: “Honestly, it spoiled the girls!! ... had a bad influence on the girls ... they use it all the time for chatting and Facebook”. In fact, one of the girls were honest enough to admit that she used the laptop several times in the class not to learn math and reported: “I use the laptop to listen to music....eh to visit websites...during the class....the girls use it all the time”. Moreover, a girl suggested that having the laptop negatively affected the rate of class attendance for some students and stated: “some girls even stopped coming to the class because they were busy with chatting outside and they did not want to stop it to go to the class”. In fact, some of the students during the focus groups also indicated that teachers felt upset because they were facing some classroom management problems when students used their laptops and got distracted during the lesson. One girl explained: “the teacher even got upset many times because of the girls who were busy chatting while she was explaining, ... she stopped the lesson many times to talk to them”.

6.2 Students attitudes towards using laptops in mathematics classrooms

Research question 2: How did the students feel about using the laptops in learning mathematics?

Another focus of the current research study was to explore students’ attitudes towards using the laptops during the mathematics lessons and their general reflections on the laptop program during the first year of implementation. In the third part of the questionnaire used in this study, students were asked to specify their level of agreement or disagreement on sixteen short statements written by the researcher about the use of laptops to learn mathematics, by

choosing one of the following responses: Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD). All of the 16 statements, with the frequency (f) of each item (which is number of students who choose that specific response) and its mean score (M) and Standard Deviation (sd) are summarized in table 3.

Data collected from the student questionnaires, and the students' reflections during the focus groups were combined together to come up with the major finding of this study. The outcome numbers and percentages from the questionnaire reveal that neither students have perceived the laptops as the perfect learning tool for mathematics nor they totally discarded it. Results from the focus groups show that some students did not like using the laptops to learn mathematics at all, but the answers of some other students also indicate that there were certain aspects of using the laptops that they see it useful in learning mathematics.

Although almost 80% of the students (50 out of a total of 58) strongly agreed/agreed on item number 8 that "I prefer the teacher using the board to explain the lessons" with a mean score of 4.47 (sd=0.90), the students' answers on some different items like items number 9, 10 and 15 as examples, show that they at the same time understand the various benefits of using the laptops in mathematics classes. On item number 9 "laptops help us in getting useful material, like worksheets and extra exercises", 44 girls representing about 75% of the students strongly agreed/agreed with a mean score of 4.11 (sd=0.99) and 39 students representing close to 70%, strongly agreed/agreed on item number 10 "laptops give chances to have more practice exercises and quizzes" with a mean score of 3.91 (sd=1.08).

Table 3

Students' attitudes about using the laptops in mathematic classes.

Items	SA f (%)	A f (%)	N f (%)	D f (%)	SD f (%)	NR f (%)	Mean f (%)	Sd f (%)
1. The laptops help in getting better grades in math tests	5 (8.62)	10 (17.24)	15 (25.86)	12 (20.69)	14 (24.14)	2 (3.45)	2.64	1.27
2. I prefer using the laptops over the paper and pencil	7 (12.07)	9 (15.52)	10 (17.24)	13 (22.41)	19 (32.76)	0 (0)	2.52	1.39
3. I like using the laptops in the class for learning mathematics	6 (10.34)	6 (10.34)	25 (43.10)	10 (17.24)	9 (15.52)	2 (3.45)	2.82	1.16
4. Laptops should be used for the whole period (50 minutes)	0 (0)	5 (8.62)	14 (24.13)	27 (46.55)	10 (17.24)	2 (3.45)	2.25	0.86
5. I will get the same grade in math tests with or without the use of laptops	6 (10.34)	10 (17.24)	12 (20.69)	20 (34.48)	8 (13.79)	2 (3.45)	2.75	1.22
6. Laptops makes the communication with the teacher easier	10 (17.24)	23 (39.66)	15 (25.86)	6 (10.34)	3 (5.17)	1 (1.72)	3.54	1.07
7. Using the laptops in learning mathematics is a waste of time	6 (10.34)	7 (12.07)	19 (32.76)	18 (31.03)	6 (10.34)	2 (3.45)	2.80	1.13
8. I prefer the teacher using the board to explain the lessons	38 (63.79)	12 (20.69)	4 (6.90)	2 (3.45)	1 (1.72)	1 (1.72)	4.47	0.90
9. Laptops help us in getting useful material, like worksheets and extra exercises	24 (41.38)	20 (34.48)	10 (17.24)	1 (1.75)	2 (3.45)	1 (1.72)	4.11	0.99
10. Laptops give chances to have more practice exercises and quizzes	20 (34.48)	19 (32.76)	11 (18.97)	4 (6.90)	2 (3.45)	2 (3.45)	3.91	1.08
11. The Laptop is a distracter	9 (15.51)	16 (27.59)	17 (29.31)	11 (18.97)	3 (5.17)	2 (3.45)	3.30	1.13
12. I learned a lot by using the laptops in math classes.	8 (13.79)	24 (41.38)	17 (29.31)	4 (6.90)	3 (5.17)	2 (3.45)	3.54	1.01
13. It is more fun to use the laptops in the class	11 (18.97)	13 (22.41)	21 (36.21)	7 (12.07)	3 (5.17)	3 (5.17)	3.40	1.12
14. I finish my work faster by using the laptops	11 (18.97)	13 (22.41)	24 (41.38)	6 (10.34)	2 (3.45)	2 (3.45)	3.45	1.04
15. Laptops is good to review for the tests and final exams	19 (32.76)	18 (31.03)	8 (13.79)	8 (13.79)	3 (5.17)	2 (3.45)	3.75	1.22
16. In general, I am happy that I am using the laptop in the math class	10 (17.24)	9 (15.51)	27 (46.55)	4 (6.90)	6 (10.34)	2 (3.45)	3.23	1.16

*NR= Not responded (f=frequency and sd=standard deviation)

Advantages of laptops during mathematics classes

Although 13 girls (about 22%) agreed/strongly agreed on item number 7 “ using the laptops in learning mathematics is a waste of time” , still 24 students representing almost 41% disagreed/strongly disagreed with this statement and the remaining students (almost 33%) were neutral. However, none of them strongly agreed and only 5 students (about 9%) agreed on using the laptop for the whole mathematics period (for 50 minutes). In fact, 37 girls (representing almost 64%) disagreed/strongly disagreed on item number 4 “laptops should be used for the whole period (50 minutes)”. These results indicate that students somehow still perceived the laptop as a useful tool in certain aspects and areas in learning mathematics and that they did not totally reject it.

Results from the focus group validated these percentages and gave a comprehensive explanation of the previous results. When the researcher asked the students to state the advantages of using the laptops during mathematics classes the following replies were transcribed: “what is good about the laptop, we can find more exercises to solve as practice on BBV specially when we have tests”, “ we have more practice exercises on laptops ...on BBV...it is a good training on testing procedures...and the feedback is good, when I write a wrong answer directly I get a feedback with the correct answer”, “I feel more organized with the laptop...the teacher puts deadlines for the exercises on BBV, after the deadline it is closed and I cannot use it again...this gives a motive to finish on time”, “Sometimes we lose the worksheets and the papers ...but with the laptop we can find any sheet in the G-drive...we can even get it from home”, “...having a lot of practice questions on BBV is good...and I can open it any time and at any place like the coffee shop and the cafeteria” and “it was useful for solving math, I solve the exercises and check my work directly...it is good for revision”.

Students' general feelings

25 students (43% of the class) did not agree nor disagree on item number 3 “I like using the laptops in the class for learning mathematics”, 12 girls (almost 21%) strongly agreed/agreed and 19 girls (almost 33%) disagreed/strongly disagreed on this item. When the researcher asked the students to reveal their attitudes towards using the laptops in mathematics classes during the focus groups, some students indicated that they did not like the experience at all. One of the students' answers was: “I do not like using the laptop in the class, it makes things for me more complicated” while another stated: “Honestly the laptop causes me a lot of pain ...” and a third said: “It is boring!!”. However, there were some other students who had positive attitudes towards the experience in general and indicated that they enjoyed it. An example is one student who talked about her experience with laptop and said: “for me I enjoyed using the laptop in some lessons...w...when we learned about time and we played online games to learn time...ya there are also good things about laptops”. There were also some students who admitted that they had some difficulties at the beginning and did not like using laptops in the class but when they got used to it they began to accept it. An example is a student who revealed: “When I first got the laptop, I did not know how to deal with it at all ...I did not know how to create a folder or even open it...I was afraid of it, it frightened me...hehe...it was very difficult...then step by step I learned how to use it and thank god now it is ok”.

When the researcher asked the students to reveal their opinion about using the laptop for the whole mathematics period, students argued that there is no point of using the laptop for 50 minutes and indicated that the teacher should explain the concepts on the board first and later they can practice on BBV using their laptops. One of the students stated: “do not use the laptop for the whole class ...for 50 minutes, 15 to 20 minutes after explaining the lesson is enough” and another said:” I prefer the teachers to explain on the board...no need for the

laptop for the whole class”. In fact one of the students argued that they should even not use the laptops every day in each class and said: “I think we should use the laptop once a week...for practice after each lesson...or on Thursdays to review what we took during the week...or to review for the tests only”.

Laptop as a distractor

The results of students’ choices on item number 11 “the laptop is a distractor” show that not all students perceive the laptops as a distractor during the mathematics classes. Although 25 girls (representing 43% of the class) agreed/strongly agreed on that item, still there were 14 students (24%) who disagreed/strongly disagreed and 17 (almost 30%) neither agreed nor disagreed on that item. However, during the focus groups almost all the students agreed that laptops should not be used while the teacher is explaining the lesson because only at that time they need to focus the most. A student stressed the importance of having the teacher to explain the concepts and to help them understand and stated:” having a teacher to explain the lesson is better than to have everything on the laptop....there are videos on BBV for each lessons but we cannot understand it alone, we need the teacher to explain”.

Paper and pencil vs laptop

It was clear from the answers on the survey questions and the discussions took place with the researcher during the focus groups that students prefer using books, papers and pencils to solve mathematical problems in the class. With a mean score 2.52 (sd= 1.39), 32 girls (almost 55% of the students) disagreed/strongly disagreed on item number 2 “I prefer using the laptops over the paper and pencil”. Students on the focus groups confirmed that they prefer using the book to solve mathematical problems when one girl stated that: “using the book is easier for us” and another replied when the researcher asked her about her opinion of using the laptop in learning mathematics: “...not nice, it is nicer to solve math on papers not on

computes”. A third girl revealed her attitudes towards using the laptops and said: “we like using the book more than the laptop in learning math...the laptop is only good for test review and practice”. When the researcher asked the girls about the reasons, one girl of the focus group explained that it is easier to write using the pen and usually they face problems when typing on the laptops when she said: “it is hard to type mathematical symbols like \div , \times , fractions and powers”. Another girl added “when I study I like to write on the book...scratch and write my own notes... I cannot do this with the laptop”. A third student indicated that it is because they did not use the laptops before coming to college in their schools and added “we were used to papers and books all the time in schools and suddenly everything changed at once”. Another girl explained that laptop distracted her during the test and stated: “I write my answers correct on the paper but when I enter it on the laptop I type it wrong ...I got distracted ...we are used to papers and pencils” and one of the students reason for not preferring the laptops was that: “For me it is better to use the book and papers and not the laptop for math...I cannot deal with math using the laptop...I must use papers and pencil...I can write anything I want and the formulas...when I study I memorize how the paper and pages look like and I recall it during the test, with laptop this does not happen”.

Laptops and students’ achievement in mathematics

When students were asked about using the laptops related their performance in math, it was very obvious from the focus group discussions and the percentages of the attitude scale that students were facing some problems with online testing using the laptops and so they perceived it as an unnecessary tool in assessments and complained that it have affected their grades in mathematics negatively. With the survey, results showed that 26 students (representing about 45%) disagreed/strongly disagreed on item number 1”the laptops help me in getting better grades in math tests” and 15 (about 25%) students were neutral, while also 15 students agreed/strongly agreed. During the focus groups students explained that there

were problems with the BBV tests and revealed that these problems caused them lose a lot of marks and they also admitted that they prefer having the tests on papers and they perceive this was as fairer to them. One student explained: “When we write on papers the teacher checks our answers...but with the laptop eh ... sometimes it does not accept correct answers....example: if the answer is 12600 ...I can write it 12,600 or 12 600 but the laptop does not accept all forms of answers...it marks 12,600 with comma as a wrong answer!!” and another girls said: “We enter the same answers on the practice BBV quizzes but we get different marks, how?...I do not like doing the tests on BBV!”. A girl criticized the BBV test and stated: “with BBV, all questions are multiple choice questions and this is not practical for math...we need to write and show the steps to the solutions”, another girl complained: “I failed when I did the test on BBV, my answers were correct, but the computer considered it wrong answers...it is more fair that the teacher correct our answers herself by hand” and a third student said: “If we use a capital letter or a comma or space when we type by mistake we might lose marks in the test...the computer only takes one correct answer and we have to write it exactly the same...this is not fair”. One of the students talked about her experience with the laptop during a mock math exam at the end of the year and stated: “For the mock exam, we solved on papers then we entered our answers on BBV. When we solved the test in the class with the teacher later, we found out that our answers on papers are correct but the computer put very low marks because the way we entered our answers was wrong”.

Laptops size and weight

One complaint cannot be ignored, that the laptop size and weight were not convenient to the students as some revealed during the focus groups. A student complained and stated that:” it is very very heavy... it breaks my back”, another student reported: “it is a very old model and very heavy...miss also its size...it is like a building brick” and a third criticized:” it is very heavy to carry from class to class”. One of the students suggested a solution and specified:

“there is no need for purchasing the laptops...there are already computer labs in the college we can use it when it is needed”.

6.3 Teachers reflections on the use of laptops in mathematics classrooms

Research Question 3: How do the mathematics teachers evaluate using laptops by the students in their classes?

The third focus of the current study was to investigate the teachers’ experiences when dealing with students using the laptops to learn mathematics, and explore how they evaluate these experiences. Results from the teacher’s questionnaires and interviews after the classroom observations were conducted, revealed that mathematics teachers had some difficulties dealing with students using the laptops in their classes and they had some concerns. However, the three teachers perceived laptops as important learning tools and believed that the laptop program need some time to start having positive outcomes.

Difficulties in classroom management

The three teachers who were interviewed admitted that dealing with students using laptops was not easy for them. In fact, when the researcher asked one of the teachers about the ways using the laptops had changed her approach in teaching and managing her classes, the following conversation transpired:

Researcher: *do you think that using the laptops in your classes changed the way you teach or manage your classes?*

Teacher 1: *ya, in a sense, ya*

Researcher: *how?*

Teacher 1: *we have some technical problems, the laptop did not work, the internet is slow...what else....this is all a waste of time, which reduces the amount of teaching ...the second thing is...if you’re not strong enough or tough enough, the students might use the laptop for other things*

Researcher: *ahhha!!*

Teacher 1: *they do not listen to what you say, you can go around and see what the sites they open....so it is really..... You need extra time actually to give what you need to give for that period, if you are using the laptop*

Researcher: *do you think it has made things more difficult for you? More hard?*

Teacher 1: *sometimes yes, yes.....it is a waste of time more likely!*

Another teacher explained that it was hard to monitor the students use of the laptops for purposes other than learning mathematics when she indicated: “if you set your rules it [to manage the class] is not difficult but you cannot control using the messenger and surfing the internet during the lesson, which means ... you need to ...to keep your eyes hundred percent open to see what is going on...”.

Both teachers and students reported some technical problems while using the laptops. The following were some of the reported complications by the students during the focus groups: “the internet connection was slow most of the time”, “the laptop suddenly stops ...battery finished, no connection ...freezes”, and “It stops suddenly...like what happened with me during the mock exam...I could not enter my answers!” Teachers explained that with these technical problems it is harder to manage the class because they had to stop the lesson several times to deal with these issues and this wasted class time.

Teachers’ concerns about the students learning styles and educational background

The researcher found that one of the main concerns of the teachers was the educational background of their students and their learning style. Teachers explained during the interviews that dealing with laptops in classes required the shift to a more students-centered teaching strategy but the students were more used to a teacher-centered classroom and that was the main problem. One of the teachers talked about her students and said: “they are not independent learners at all ... we need to explain everything for them on the board” and added “the problem is with the students...they are not used to this...they are used to having

the teacher in front of them to teach them everything ... the students are not trained right from the beginning when they come to us, they are very dependent”.

When the researcher asked another teacher if it is difficult to deal with students having their laptops in her class, she replied:” ya definitely... with the level of my students...I think if they were trained to use it to learn through it before it would be easier for me now” and she added:” I have students who are not motivated to learn, they use it for chat or email”.

Teachers’ reflections on online assessments with laptops

Students during the focus groups indicated that they were facing problems with tests on BBV. For that reason the researcher tried to inspect teachers’ experiences with the laptops in their classes when students used it for assessments, and so teachers were asked to reveal their opinion and share their experiences during the interviews. Teachers’ answers indicated that they did not perceive laptops as affective tools for doing assessments and they believed that using the laptops for testing had affected negatively students’ achievement in mathematics. One of the teachers explained as follows:

Researcher: *how about assessments? Do you think it will make a difference if the students have the test online and no on papers?*

Teacher1: *they do much better when they do the test on papers, sometimes it is the problem of the test itself, if they write 1280 with a comma it might be considered as a wrong answer because of the comma, because the test was made to consider 1280 without a comma as a correct answer!*

Researcher: *what about if you put all the questions as multiple choice questions?*

Teacher 1: *no, I do not believe in multiple choice questions*

Researcher: *emm*

Teacher1: *one or two questions it is ok, but not all...it does not show how much the students understand the concept.*

Researcher: *emmm*

Teacher1: *multiple choice questions, true or false, fill in the blanks are not for math we need to see the steps they followed to get the final answer.*

Researcher: *do you feel your students like using the laptop during the math classes?*

Teacher1: *no, not all the time, especially the tests they also prefer it on papers.*

Mathematics teachers explained that when students have a test on papers, they write all the steps they follow to reach the final answer. In this case, teachers are able to indicate the level of the students' understanding of the explained concepts. However, when students have a test on BBV, they are only required to enter their final answer and it is not possible to show all the steps followed to reach this answer, and therefore teachers can hardly tell which students understand the concepts fully and which do not. Teacher 3 revealed that she prefers the test on papers and stated: "personally in math I like traditional paper and pencil exams, I like to see the steps....I like to see solutions; if they make a mistake I can see where we do not have these tools on laptops to show all of these things". Moreover, when teachers prepare the test on papers they allocate marks for every single step followed by the students, so students will definitely get higher marks. Teacher 2 also explained " there is a gap....when you mark a paper they will get a partial mark, but because it is online...the questions are true or false or multiple choice they will not get this partial mark...so their marks are dropping".

CHAPTER 7

DISCUSSION, RECOMMENDATIONS AND CONCLUSION

This study investigated the first year of implementation of a laptop program at the female campus of a college in the United Arab Emirates. The study focused on the utilization of the laptops during classes of three mathematics teachers in order to provide richer data related to the UAE students experiences with laptops in learning mathematics. Specifically, the study looked at the different ways the students and their teachers used their laptops in the class, the problems they faced during the first year of implementation and both the students and the teachers' reflections on the whole experience with laptops. Although both quantitative and qualitative data reveal a general disappointment by the students of the whole experience overall, this disappointment can be explained in terms of different factors. And therefore, it can provide vital insights to improve the implementation of the laptop program in the college in the coming years.

7.1 Discussion of the results

Results of this study reveal that laptops were not used frequently and effectively enough in the mathematics classrooms. Students did not use their laptops for almost half of the class time and when they used it, the main purpose of the use was to do practice exercises on Blackboard Vista. In fact, these findings are similar to the results of previous studies that revealed that laptops are being used the least frequently during the mathematics classes compared to other subjects (Lemke & Martine, 2004, cited in Holcomb, 2009).

In mathematics classrooms, the students were asked to close their laptops to listen to the teachers while they explain. These practices were also reported previously by research studies at universities where the "laptop-up laptop-down system" was activated by the faculty who

were concerned about the distraction posed when the students used their laptops during the lectures (Levine, 2002). This indicates that teachers were not trained enough to use laptops as tools for exploration and experimentation to learn mathematics. Martinez (2009) argues that “Professional development for teachers related to laptops tends to focus on the logistics of using laptops and learning new features. This leaves the most important and most difficult changes to chance, such as expectations that the learning will become more students-centered, teaching will become more collaborative and project based, the students will become more- self-directed learners”. Moreover, the three observed mathematics teachers were lecturing for more than 54% of the observed time. Teachers mostly projected the student’s book on the board and explained to the students and that was the main reason for some of the students’ distraction. It was proven by research that: “In studies where laptops proved to be more of a distraction than a benefit, the main teaching strategy was a traditional lecture. In order to maximize the benefits of laptops in higher education, it may be necessary to develop meaningful laptops based activities and move away from the passive dissemination of knowledge” (Kay & Lauricella, 2010).

In the current study, students revealed in general negative attitudes towards computers in mathematics learning although they pointed out some of its benefits. These negative attitudes can also be explained. First, most of the students are coming from government schools in the United Arab Emirates (UAE). Students of the government schools in UAE usually do not use laptops as a learning tool for mathematics in the classrooms and so they depend heavily on the teacher and believe that teachers are the main source of information (Saunders & Quirke, 2002; Makrakis, 2005). Research findings prove a relationship between the level of usage of computers or computer familiarity and the perception of its usefulness (Koohang, 1989; Baack, Brown, and Brown, 1991). The students of the current study were not familiar with laptops in their previous schools. So, they did not have enough experiences to build believes

of its usefulness as learning tools. After coming to the college, the three mathematics teachers used to ask the students to keep the laptops closed for half of the class time, and they only used it for practice on BBV; therefore, students did not use it enough to have the chance to build perceptions of usefulness of laptops as a learning tool in mathematics. Moreover, while male students, regardless of the level of familiarity with computers, usually display positive attitudes towards them, female's attitudes become more positive as they grow their level of acquaintance with computers (Sacks, Bellisimo and Mergendoller, 1993). This research finding suggests that the girls in the current study need more time and experiences with laptops to start displaying positive attitudes towards them.

Research studies also suggest a positive correlation between the experiences with computers and the beliefs towards them (Gardner, Dukes & Discenza, 1993), so negative experiences with laptops may lead to negative attitudes towards them. The students of the current study faced negative experiences with the laptops when they used it for assessments. Focus group discussions revealed that students had problems with mathematics assessments on BBV because the answers must be entered in a special format, and so not all correct answers with different formatting were taken into account. This has led to lower achievement in mathematics and so students had negative experiences with the laptop and therefore they formed negative attitudes towards it. Negative attitudes also emerged because students were facing technical problems and were complaining about the laptop size and weight. The girls revealed that the laptop was heavy for them to carry from class to class and its size was not practical. The internet speed was slow and the computer used to freeze suddenly specially during exams. All of these bad experiences with laptops explain the students' rejection of the program at the first year of implementation.

Moreover, although teachers indicated in the interviews and questionnaires that the college provided some professional development sessions, these sessions focused mainly on getting

familiar with the features of the laptop and writing assessments with Blackboard Vista. The biggest challenge, when implementing laptops program, goes beyond developing teachers' technological skills and involves instead, helping the teachers develop the necessary expertise to build worth computer-based lessons which is usually a hard task to accomplish (Mouza, 2008).

In the current study, the main purpose of using the laptop in learning mathematics was drill and practice. Research studies reveal that: "teacher are more likely to have students use computers for routine skills practice and are less likely to have students use computers to make presentations, do analytic work, revise and publish text, or engage in exploratory and problem-solving activities (Becker, 2001; cited in Mouza 2008). To attain real gains, laptops should be used to support knowledge-building rather than support learning environments where students act as passive learners and teachers are the only source of knowledge (Donahue et al, 2001; cited in Mouza 2008).

For assessments, the mathematics teachers used Blackboard Vista to design online tests to evaluate students understanding of the previously explained concepts. These tests were composed of a bunch of multiple choice questions, fill in the blanks and true or false questions. Teachers used to prepare a test on papers then copy the questions from the paper to BBV. Students during the focus group discussions explained that when they solved the same test on papers they got higher marks than with laptops because they lost the partial marks they usually get for writing the steps they followed to solve a multistep question. Ashton et al. (2006, pp.93, 95) support the students' argument and explain how marks differ in both mediums as follows:

Partial credit in mathematical examinations has for some time been known to be a potential source of difference between examinations on paper and those on computer. This is because a human marker will award some marks (partial credit) for an answer that is partially but not fully correct.....Assessment on computer normally marks an

incorrect answer wrong and awards no marks. This can lead to discrepancies between marks awarded for the same examination given in the two different media.

To overcome this problem, Ashton and Youngson (2004) suggest splitting the long question with many steps into parts, this way the students will have the chance to start again in the coming part without carrying previous errors to the next step and lose marks for all.

The use of laptops for purposes other than learning mathematics in the classroom like using the messenger to chat, play online games, visit websites and using the Facebook was also reported many times by the students during the discussions. Teachers also reported that some students used the laptops in their classes to download music, chat, or socialize with Facebook. Similar practices of the students' misuse of laptops in the classrooms were reported by Barckuus (2005), Hu (2007), Foster (2008), Fried (2008) and Fishman (2009). However, some argue that these practices are normal and part of everyday life and teachers should expect such behavior by some students in the class (Rockman, 2007) and despite of such reports; higher education institutions has been "aggressive" in adopting programs to integrate laptops into the instructional environments (Hawkes & Hategekimana, 2010) and the college where the current study took place in one of these institutions and teachers should adopt with these programs.

7.2 Recommendations

Based on the results of the current study the following recommendations are formulated to increase the effectiveness of the laptop program in the mathematics classes. These recommendations are directed to both teachers and decision makers at the college to take into account while preparing for the coming academic years.

7.2.1 Teachers' professional development

If laptops are not integrated in the course then it should not be used in the classes (Barak, Lipson & Lerman, 2002). Teachers should find a way to assure that the students use their laptops in mathematics classes as a learning tool. Therefore, more attention should be given to the professional development of the teachers. The college should provide workshops that cover the “Technological Pedagogical Content Knowledge” (TPCK) for teachers (Mishra & Koehler, 2006). According to Mishra and Koehler (2006) “TPCK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones” (Figure 5).

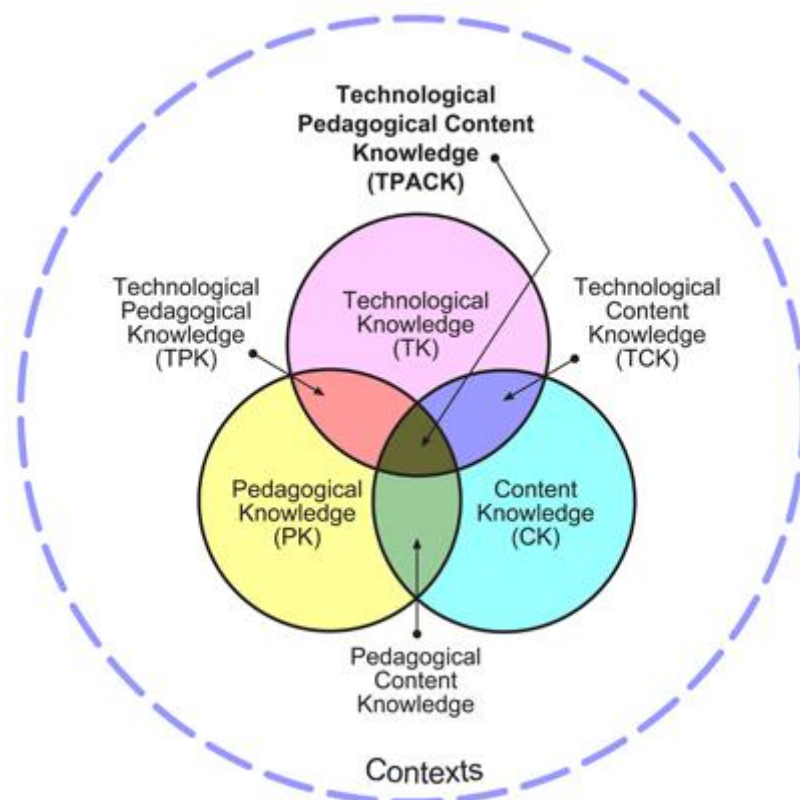


Figure 5: Technological Pedagogical Content Knowledge

Source: <http://tpack.org/>

7.2.2 Mathematics assessments design

Mathematics teachers should pay extra attention to the assessments that are built using BBV. Students' complaints should be taken into consideration. Mathematics tests and quizzes should be designed in a way that accepts all the forms of the correct answers regardless of its format, and should be designed in a way that reduces the typing mistakes of the students like using multiple choice questions instead of fill in the blanks. Teachers should add alternative answers to each question when possible. And when teachers wish to check all the steps followed to solve a mathematical problem, Ashton and Youngson (2004) suggested solution to this kind of questions which recommends splitting the long question it to parts, would be one of the solutions.

7.2.3 Laptops use regulations

Teachers should work together to develop guidelines and set rules for the students use of laptops in the class, and produce a document that includes clear directions on when, where and how to it in the classroom plus the consequences of the misuse of laptops to be signed by the students at the beginning of the year (Rockman et al, 2004). Moreover, to monitor the students' use of laptops and control it during the class time, software like NetSupport School that allows teachers to view students screens, monitor instant messaging and prevent using them, and switch on/off all computers in the class (www.netsupportschool.com)

7.2.4 Other alternatives

Since many students complained about the heavy weight of books and laptops together they carried everyday a solution would be to replace the hard copy of the students' book with a soft copy on the laptop or use an e-book. In fact, using notebook computers or tablet PCs like the ThinkPad where the students can manipulate the screen and enter data by using an electronic pen would be a good solution for this issue (www.lenovo.com).

7.3 Limitations

The current study has a number of limitations. First, the study was conducted with 58 female students in the foundation year (first year of college) taking the same mathematics course. This sample was relatively small to conduct a survey and the results might change if the study included boys. Moreover, the study was conducted in a limited number of classrooms with three mathematics teachers teaching the same course, which is an introductory level class. So the results cannot be generalized to all mathematics classrooms.

7.4 Conclusion

This study attempted to explore the Emirati female students' experiences with laptops in mathematics classes in a college in UAE. Both qualitative and quantitative methods of data collection were used to investigate how laptops were being used in learning mathematics and to inspect the students' attitudes towards it and teachers' reflections on the classroom experiences with the new medium. Data from questionnaires and focus groups indicate that students appreciated some of the laptops benefits but they have developed negative attitudes towards using it in learning mathematics during the first year. Despite of the bunch of the negative results reported by both the students and the teachers participated in this study; the study contributes in giving insights for teachers for better future practices. A good suggestion for future research in this domain would be conducting the same study to investigate Emirati male students' experiences with laptops in the first year to compare it with the results of this study.

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Appendix A

A student's questionnaire about using the laptops in mathematics classrooms.

استبيان الطلاب لاستخدام الكمبيوتر النقال في صفوف الرياضيات

This questionnaire investigates the students' attitudes and perceptions about using the laptops in the mathematics classes. It consists of three parts: General questions, how laptops are being used in the classroom, and students' attitudes towards using the laptops in mathematics classes.

Please take your time to answer all the questions below. There will be no names mentioned and be sure that your feedback will remain confidential.

هذا الاستبيان مصمم للإطلاع على مشاعر التلاميذ وانطباعاتهم اتجاه استخدام الكمبيوتر المحمول في صفوف الرياضيات. يتألف الاستبيان من ثلاث أجزاء: أسئلة عامة حول الموضوع، طرق استخدام الكمبيوتر النقال في صفوف الرياضيات، مشاعر و انطباعات التلاميذ اتجاه استخدام الكمبيوتر النقال في صفوف الرياضيات.

نرجو أخذ الوقت اللازم للإجابة على الأسئلة. لا يوجد ذكر للأسماء وتأكيدي بأن جميع الإجابات ستبقى سرية.

Part 1: General questions

الجزء الأول: أسئلة عامة

- Did you have a laptop before coming to college?
 - No
 - YesIf yes, when did you have your first one?.....

• هل كان لديك كمبيوتر نقال قبل الدخول إلى الجامعة؟

- لا
- نعم
- إذا كان جوابك نعم، متى حصلت على أول جهاز؟

.....

- For how long have you been using the laptops in the classrooms?
 - For one semester
 - For two semesters
 - More/less (specify)

• منذ متى بدأ استخدام الكمبيوتر النقال في الصفوف الدراسية؟

- فصل دراسي واحد
- فصلان دراسيان اثنان
- أقل-أكثر (نرجو التحديد):

- Did you feel comfortable using the laptop at the beginning when the college provided it to you?

- Yes
- No

Why:

.....
.....
.....

• هل كان استخدام الكمبيوتر النقال مريحاً في البداية عندما حصلت عليه من الجامعة؟

- نعم
- لا

○ لماذا:

.....

.....

- Did they provide technical help and training on using the laptop at the college when you first got your laptop?

- Yes
- No
- Comments:

.....
.....
.....

- هل حصلت على مساعدة تقنية وتدريب على استخدام الجهاز من قبل الجامعة في البداية؟

○ نعم

○ كلا

○ نرجو التعليق:

.....
.....
.....

- Do you feel more comfortable using the laptop now?

- Yes
- No
- Comments:

.....
.....
.....

- هل استخدام الكمبيوتر النقال مريح الآن؟

○ نعم

○ لا

○ نرجو التعليق:

.....
.....
.....

Part 2: How are the laptops being used in mathematics classes?

الجزء الثاني: كيف يتم استخدام الكمبيوتر النقال في صفوف الرياضيات

- Are you using the laptop in math classes?
 - Yes
 - No

- هل تستخدمين الكمبيوتر النقال في صفوف الرياضيات؟
 - نعم
 - كلا

If yes then answer the following questions.

إذا كان جوابك نعم، أجبني على الأسئلة التالية

- For how long to you use your laptop in the math class in general.
 - 5-10 min/class
 - 10-20 min/class
 - 20-30 min/class
 - 30-40 min/class
 - The whole class

- تقريباً، ما المدة التي تستخدمين فيها الكمبيوتر النقال في صفوف الرياضيات؟
 - 5-10 دقيقة من مدة الحصة
 - 10-20 دقيقة من مدة الحصة
 - 20-30 دقيقة من مدة الحصة
 - 30-40 دقيقة من مدة الحصة
 - طوال مدة الصف

- In what ways are you using the laptops in learning mathematics?

.....

.....

.....

.....

.....

- كيف يتم استخدام الكمبيوتر النقال في حصص الرياضيات؟

.....

.....

.....

.....

.....

- Do you use the laptop at home for studying purposes?(e.g. solving a home work or extra practice exercises), Elaborate.
 - No.
 - Yes.

How:

.....

.....

.....

.....

- هل تستخدمين الكمبيوتر النقال بهدف الدراسة في المنزل؟

- لا
 - نعم
 - كيف:
-
-
-
-
-

- Do you think that Laptops are useful in learning mathematics? Explain.
 - Yes.
 - A little
 - No.

Why:

.....

.....

.....

.....

- هل تعتقدين أن استخدام الكمبيوتر النقال مفيد في تعلم الرياضيات؟

- نعم
 - قليلا
 - لا
 - السبب:
-
-
-
-
-

- In your opinion, what are the advantages of using the laptops in mathematics classes?

-
-
-
-
-

- في رأيك، ما هي حسنات استخدام ألكمبيوتر النقال في صفوف الرياضيات؟

-
-
-
-
-

- In your opinion, what are the disadvantages of using laptops in mathematics classes?

-
-
-
-
-

- في رأيك، ما هي سيئات استخدام ألكمبيوتر النقال في صفوف الرياضيات؟

-
-
-
-
-

- Give some steps to be followed by the teacher to improve the use of laptops in the class.

-
-
-
-
-

- الرجاء إعطاء بعض الخطوات التي يمكن أن يتخذها المعلم أو تتخذها المعلمة للتحسين من استخدام الكمبيوتر النقال في الصف.

..... ○

..... ○

..... ○

..... ○

..... ○

Part3: Students attitudes towards using the laptop in mathematics classes.

الجزء الثالث: شعور التلميذة حول استخدام الكمبيوتر النقال في صفوف الرياضيات.

Fill the following table by ticking that best suites you:

نرجو اختيار ما يتوافق مع شعورك:

* الجهاز: الكمبيوتر النقال

	Strongly agree أوافق بشدة	Agree أوافق	Neutral عادي	Disagree لا أوافق	Strongly disagree لا أوافق بشدة
Part 1 : Students' attitudes and perceptions					
The laptops help in getting better grades in math tests يساعدني الجهاز * في تحصيل درجات أعلى في امتحانات الرياضيات					
I prefer using the laptops over the paper and pencil أنا أفضل استخدام الجهاز على الورق والقلم					
I like using the laptops in the class for learning mathematics أحب استخدام الجهاز في تعلم الرياضيات					
Laptops should be used for the whole period (50 minutes) يجب استخدام الجهاز طوال مدة الصف (50 دقيقة) لتعلم الرياضيات					
I will get the same grade in math tests with or without the use of laptops سأحصل على نفس الدرجة بالرياضيات مع أو من دون استخدام الكمبيوتر النقال					
Laptops makes the communication with the teacher easier إن الجهاز يساعد على تحسين الاتصال مع المعلم أو المعلمة					
Using the laptops in learning mathematics is a waste of time إن استخدام الجهاز في تعلم الرياضيات مضيعة للوقت					

I prefer the teacher using the board to explain the lessons أنا أفضل أن تستخدم المعلمة اللوح (الصبورة) لشرح الدرس					
Laptops help us in getting useful material, like worksheets and extra exercises إن الكمبيوتر النقال يساعدني على الحصول على موارد مفيدة كأوراق العمل و أوراق التمرين					
Laptops give chances to have more practice exercises and quizzes الجهاز يساعدني على الحصول على تدريب أكثر مثل تمارين و اختبارات تجريبية					
The Laptop is a distracter الكمبيوتر النقال هو وسيلة ألهاء					
I learned a lot by using the laptops in math classes. تعلمت كثيراً من استخدام الكمبيوتر النقال في حصص الرياضيات					
It is more fun to use the laptops in the class من الممتع استخدام الكمبيوتر النقال بالصف					
I finish my work faster by using the laptops انهي عملي أسرع على الجهاز					
Laptops is good to review for the tests and final exams الجهاز جيد لمراجعة الامتحانات والاختبار النهائي					
In general, I am happy that I am using the laptop in the math class في الإجمال (عموماً) أنا سعيدة باستخدام الكمبيوتر النقال في صفوف الرياضيات					

Appendix B

Teacher questionnaire about the use of laptop during mathematics classes

Please take your time to fill this questionnaire about the use of laptops in mathematics classrooms.

This questionnaire is designed to investigate how laptops are being utilized in mathematics classes and explore the teachers' attitude towards it. All information provided will be treated in the strictest confidence. No one, other than the Study Team, will see the information you complete about your classes.

Part 1: Demographic Information

1. Please indicate your education background. List all the certificates you have.

-
-
-
-

2. Please indicate the number of years of experience of teaching mathematics:

..... years

3. Have you been teaching (before applying the laptops program at the college) in a class where all students use their laptops?

- Yes
- No

Part 2: ICT Knowledge and Training

1. Where you provided with training on managing classroom with laptops before/during applying the laptop program at the college?

- Yes
- No

If yes, please indicate the type of training you had:

.....

.....

.....

.....

.....

2. Do your students use the laptops in every session of your classes?

- Yes
- No.

Elaborate:

3. For what purposes are the laptops being used in your classes?

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.....

4. Briefly explain the advantages and the disadvantages of using the laptops in your classes?

Advantages:

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Disadvantages:

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.....

5. In general, how do you feel about the students' use of laptops during your classes?

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.....
.....
.....
.....

Appendix C

Observation Tool for using the Laptops in the class

Observation number:

Date:

Teacher:

Time:

Subject:

Level:

The observer will record the activities of the classroom in Five-minute intervals using a combination of check boxes and written notes.

For each interval, observe for two minutes and begin recording responses in order for the next three minutes.

Minutes	5	10	15	20	25	30	35	40	45	50
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1. Class Organization (mark all that apply)

Individual students working alone										
Pairs of students										
Small groups (3+ students)										
Listening to the teacher										

Notes:

Minutes	5	10	15	20	25	30	35	40	45	50
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2. What is the teacher's role?

Directing										
Interactive direction whole group										
Modeling whole group										
Facilitating/Coaching										
Managing behavior or material										
N/A (e.g. teacher leaves the room)										

Directing: teacher directs learning and does most or all of the talking. Provides information or explanations. Controls topic and pace.

Interactive direction: e.g. teacher initiates, students respond, teacher evaluates.

Modeling: teacher demonstrates a skill or strategy aligned with instructional goal.

Facilitating: Students do most of the work. Students interact with one another. Teacher asks questions or provides suggestions. Teacher is clarifying, Engaging, or motivating one-to-one or with a small group.

Managing: time on managing class behavior. This is not time aligned with instructional goal. Teacher is managing behavior, material, or solving computer problems in order to get students on task.

Notes:

Minutes	5	10	15	20	25	30	35	40	45	50
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3. Teacher's use of laptop (or classroom computer on teacher's desk) (mark all that apply)

To present information										
To model a skill or strategy to large group										
For grading, attendance, or material preparation										
To retrieve information										
Other (like not for educational purposes)										
Not using										

Notes: Describe technology used (e.g. name of software, items other than computer –digital camera, smart board, etc...)

Minutes	5	10	15	20	25	30	35	40	45	50
---------	---	----	----	----	----	----	----	----	----	----

4. Student's use of laptop

To retrieve information										
For communication purposes										
Use productivity tools										
Use of specific software for math										
Other (write down)										
Not using										

Retrieve information: using internet search engines, websites, teacher's website, online databases, etc...

Communication: using e-mail, bulletin board, tweeter, Edmodo, face book, etc...

Productivity tools: like Word, Excel, access, PowerPoint, Movie maker, OneNote, etc...

Specific software for math: like Cabri, sketchpad, autograph, math crocodile, etc...

Other:

Notes: Describe technology used (e.g. name of software, items other than computer –digital camera, smart board, etc...)

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Minutes	5	10	15	20	25	30	35	40	45	50
---------	---	----	----	----	----	----	----	----	----	----

5. Purposes of the student's use of laptop in learning math/out of the time the laptops used by the students for learning math.

To learn a new skill, strategy, fact, theory...										
To practice on a given topic										
For assessment purposes (online quizzes and tests)										
Searching for a real life application on the given topic										
Other (write down)										

Learn a new skill: students learn a new mathematics theory or fact or strategy of solving a mathematical problem alone with the direction of the teacher by using a website or an already prepared material by the teacher on Back board for instance.
 Practice: to solve more exercises on an already given topic using a specific website, teachers website, Edmodo, or Blackboard vista.
 Assessment: to perform an online quiz or a test or submit a paper.

Notes:

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Part 2: Other observation notes.

1. Number of students in the class:
2. Did all the students have their laptops? If no, how many did not have their laptops?
3. Describe how students brought laptops into the room, began working, and closed up at the end of the class:

4. Briefly describe the lesson.

5. Overall, what was the teacher's role in the class?

6. Did you notice any student/students who were using the laptop for other than the educational purposes? If yes, then describe how?

7. On average, how was the students' level of technical skills? - Need a lot of help -somehow skilled but need the help of the teacher -Independent

8. On average, how often were students engaged? -Almost always - Sometimes -Almost never

9. Other comments about the observation?

Part 3: Map of the classroom layout

Indicate the layout of the classroom, including arrangements of desks and where the teacher is relative to the students. If the layout changes during the class, try to indicate how things changed by using arrows or other symbols.

Part 4: The teacher interview questions

- 1) For how long have you been teaching in a class where students use their laptops?
- 2) Why did you decide to include using the laptops in your lessons and do you think it was useful?
- 3) For what purposes do you usually use the laptops in your classes?
- 4) What do you think about it in general?
- 5) What are the obstacles you are facing in the classes where students use their laptops?
- 6) Do you think laptops have affected the students' marks in math?

Appendix D

Focus groups category table

Themes	Theme 1 <i>“Attitudes towards using laptops in the classrooms”</i>	Theme 2 <i>“Technical problems Faced during the use of laptops”</i>	Theme 3 <i>“Laptops and assessments”</i>	Theme 4 <i>“Suggestions for better future use of laptops for learning mathematics”</i>	Theme 5 <i>“Laptops as Distractor”</i>	Theme 6 <i>“paper and pencil over the laptop use”</i>	Theme 7 <i>“Some benefits”</i>
FG1	“we did not like at the beginning because we were not used to it”	“the internet connection was slow most of the time”	“We fail more with laptops ... usually without laptops when we write on papers we show all the steps to find the solution, so we get marks for all these steps plus marks for the final answer but with the laptop you get marks for the final answer only because all the tests are multiple choice questions so we get less marks ”	“use the laptop only for practice” “do not use the laptop for the whole class ...for 50 minutes, 15 to 20 minutes after explaining the lesson is enough”	“ ...it is a big distractor” “The girls always open the messenger during the class time ...the teacher does not know ... they have their ways to hide it ...hehehe”	“we were used to papers and books all the time in schools and suddenly everything changed at once”	“what is good about the laptop, we can find more exercises to solve as practice on BBV specially when we have tests”
	“now I am used it but still I prefer not to used it during the class time”	“the laptop suddenly stops ...battery finished, no connection, ...freezes”	“some time the system stops suddenly so we have to repeat everything we made because the answers are not saved”	“ we use the Arabic language for Facebook and chatting, if we use the Arabic language for the laptop at the college we will find it easier”	“Honestly, it spoiled the girls !! ... خرب البنات!! ... Had a bad influence on the girls ... they use it all the time for chatting and Facebook”	“I write my answers correct on the paper but when I enter it on the laptop I type it wrong ...I got distracted ...we are used to papers and pencils”	

	“honestly I did not like it, I feel that doing math should be on papers and teachers should use the board to explain”			“Teacher explains the lesson on the board ... then send us the PowerPoint by mail to review it at home and solve the homework...then we send it back to her to check our answers”			
	“solving mathematical exercises is harder when we use the laptop”			“use the hardcopy of the test to write on then we enter our answers on the laptop”			
FG2	“ I do not like using the laptop in the class, it makes things for me more complicated”	“bad internet connection ...very slow”	“Looking only at the final answer does not reflect whether we understand the lessons or not ...the students can easily cheat ...but when we have to show our steps ... on papers, eh ...it is hard to copy it all...”		“	“When we write on papers the teacher checks our answers...but with the laptop eh ... sometimes it does not accept correct answers....example : if the answer is 12600 ...I can write it 12,600 or 12 600 but the laptop does not accept all forms of answers...it marks 12,600 with comma as a wrong answer!!”	
		“it is very heavy to carry I from class to class”	“The level of the questions on BBV is very hard and it is harder than what is on			“it is hard to type mathematical symbols like \div , \times , fractions and	

			the book...the language is difficult...we know how to solve but we do not understand it!!”			powers ...”	
		“the battery is empty quickly”				“using the book is easier for us”	
FG3	“When I first got the laptop, I did not know how to deal with it at all ...I did not know how to create a folder or even open it...I was afraid of it, it frightened me...hehe...it was very difficult...then step by step I learned how to use it and thank god الحمد لله now it is ok”	“It stops suddenly...like what happened with me during the mock exam...I could not enter my answers!”	“Cheating is easy when we use the laptops for the tests... any student can Google anything,...or use the msn to communicate with others”	“I think we should use the laptop once a week...for practice after each lesson...or on Thursdays to review what we took during the week...or to review for the tests only”	“if we use the laptop during the lesson, no one will be listening to the teacher”	“when I study I like to write on the book...scratch and write my own notes...I cannot do this with the laptop”	“ we have more practice exercises on laptops ...on BBV...it is a good training on testing procedures...and the feedback is good, when I write a wrong answer directly I get a feedback with the correct answer”
	“it is better not to use the laptop while the teacher is explaining the lesson ... no one...no one will be listening” “if it is up to us, we prefer not using the laptop at all”		“the girls are even sending emails with the answers”			“For me it is better to use the book and papers and not the laptop for math...I cannot deal with math using the laptop...I must use papers and pencil....I can write anything I want and the formulas...when I study I memorize how the paper and pages look like and I recall it during the test, with laptop this does not happen”	“I feel more organized with the laptop...the teacher puts deadlines for the exercises on BBV, after the deadline it is closed and I cannot use it again...this gives a motive to finish on time”

	"it is affecting my sight badly ...I already have sight problems and it is increasing with the use of the laptop"						"Sometimes we lose the worksheets and the papers ...but with the laptop we can find any sheet in the G-drive...we can even get it from home"
FG 4	" we do not even use the laptop at home for studying"	"have of us do not have internet connection at home so we cannot use it to solve homework"	"We enter the same answers on the practice BBV quizzes but we get different marks, how...I do not like doing the tests on BBV!"	"I prefer the teachers to explain on the board...no need for the laptop for the whole class"	"I use the laptop to listen to music....eh to visit website...during the class....the girls use it all the time"	"it is harder to solve questions using the BBV...eh typing is hard...I feel the questions are even harder on BBV....we are used to worksheets and books"	
	"it was easy for me to deal with the laptop because I used the laptop before at the school...it is not new to me"	"there are a lot of problems with the laptops...it suddenly stops working...it freezes some time,...the battery finishes very fast..."	"with BBV all questions are multiple choice questions and this is not practical for math...we need to write and show the steps to the solutions"	" do not use the laptop in the class...that's it"	"When I open the laptop during the class I directly get distracted... I cannot even listen to the teacher ...I prefer not to use it in the class"		
	"When I first got the laptop I could not deal with it at all !! ...ابدأ ابدأ ابدأ"				"We use the messenger in every class!!"		
	"with math there is no need to use the laptop at all"						
	" I like using the laptop even during the mathematic classes"						

FG 5	"Honestly the laptop causes me a lot of pain ... !! يلوع الكبد!"		" I failed when I did the test on BBV, my answers were correct, but the computer considered it wrong answers...it is more fair that the teacher correct our answers herself by hand"	" we do not use the laptop in every class so we carry it for nothing!...i wish the teacher specifies a day where we all bring the laptop to have work to do with it"	" in the class, the teacher explains while the girls are completely involved in chatting"		"...having a lot of practice questions on BBV is good...and I can open it any time and at any place like the coffee shop and the cafeteria"
	"It is boring!!"	"This laptop is not good, and it is heavy ...very heavy...half of the girls did not like to carry it all the time....plus, It is expensive!!" " ...ya.... not all can afford its price"	" ...if we use a capital letter or a comma or space when we type by mistake we might lose marks in the test...the computer only takes one correct answer and we have to write it exactly the same...this is not fair"		"... some girls even stopped coming to the class because they are busy with chatting outside and they do not want to cut it"	"...not nice, it is nicer to solve math on papers not on computes"	" the laptop is useful for the teacher, it saves her time to do al the corrections and also it is good for us, we can directly get the feedback of our work ...we do not have to wait for the teacher to finish correction after few days to know our mistakes "
	" for me I enjoyed using the laptop in some lessons...w...when we learned about time and we played online games to learn time...ya there are also good things about laptops"				"the teacher even got upset many times because of the girls who were busy chatting while she was explaining ... she stopped the lesson many times to talk to them"		
	" I like and enjoy using the laptop for music and chatting and movies but for studying I do not like it"				"... خربهم بعد it has a bad influence on the girls!! they are failing because of it"		

FG 6	“The laptop was very heavy, it raised my blood pressure!!”	“ it is a very old model and very heavy...miss also its size...it is like a building brick”	“BBV test scores are different from the grade put by the teacher....the computer considers the answer wrong simply if we add a comma between the digits or space or a point at the end of the answer”	“there is no need for purchasing the laptops...there are already computer labs in the college we can use it when it is needed”	“miss, it is a big distractor....I feel that all girls are using it for chatting and messenger”	“ we like using the book more than the laptop in learning math...the laptop is only good for test review and practice”	“the laptop has both the good and the bad side, example...we can use it anywhere and anytime to solve exercises...but it is heavy and we have a lot of exercises to solve every day...it is too much”	
	“having a teacher to explain the lesson is better than to have everything on the laptop....there are videos on BBV for each lessons but we cannot understand it alone, we need the teacher to explain”							“it was useful for solving math, I solve the exercises and check my work directly...it is good for revision”
								“ what was useful is the college portal and system...we have the s-drive and the G-drive...when we need anything we search there to find it”
FG 7	“I do not prefer using the laptop for math at all...only for printing papers and search for information because the teacher explains better and when we solve on papers we grasp the information	“...the computer suddenly stops working” “it is very very heavy...it breaks my back”	“For the mock exam, we solved on papers then we entered out answers on BBV. When we solved the test in the class with the teacher later, we found out that our answers on papers are correct but the computer put very low marks because the	“even if you give us the PowerPoint presentations each lesson, we still need the teacher to explain and help”	“for sure we get distracted when we use the laptop...I open other sites when we use the laptop in the class”	“ we used the laptop for math and English, but for math it was very hard for me to use it because I feel that using the pen and papers is more useful”	“ it is useful to search for information and printout worksheets”	

	more...plus the computer some time suddenly stops working”		way we entered our answers was wrong”				
	“It is hard to use the calculator on the laptop it has different symbols than the regular calculator, * for multiplication and / division!!...we are not used to it”			“ I prefer to use half of the class time for the teacher to explain on the board, then the second half using the laptop for practice on the concepts explained earlier”	“ it is a waste of time, it needs time to start, enter the password, open the file....unlike using the book, directly we open it without this waste of the time”	“ typing mathematical symbols is hard...a lot of girls do not know how to write a fraction for example”	“using the power point presentations for explaining the lesson is nice and useful”
	“we have wasted a lot of time this semester on laptops,...I wish we had used this time to focus more on learning math”			“we can use the computer laps when we need to use the computers,...we are tired of moving around from class to class carrying the laptop...hard”			
	“the laptop is harmful and it hurts my eyes”						

Appendix F

Teachers' interviews Transcripts

Date: May 9, 2010

Interview with Teacher 1.

RESEARCHER: For how long have you been using laptops with your students?

TEACHER1: ...one year...ya3ni for two semesters

RESEARCHER: Ok, ehhhh...how are you using the laptops with the students?

TEACHER1: mmm... working on BB Vista, doing quizzes

RESEARCHER: Online quizzes?

TEACHER1: Online quizzes (agreeing), ehhhhhh...one of the tests we did as well ...

RESEARCHER: mmmm..

TEACHER1: I think test one, so we did one test, ah and the mock exam we did the ...eh..they did the test one papers and the answers they transfer it to theBBV, revision

RESEARCHER: how?

TEACHER1: revision, we having activities using the portal, aaaaand some exercises on BB Vista!

RESEARCHER: mmmm, ok , do you think it is useful for teaching mathematics or learning mathematic if you talk about your students?

TEACHER1: it is good in a sense, but not the core of teaching

RESEARCHER: e mm

TEACHER1: as a facilitator, but not to concentrate on the laptop as everything, ya

RESEARCHER: can you explain more?

TEACHER1: look I believe for our standards, for our students I believe on board and chalk

RESEARCHER: ok?

TEACHER1: Although, maybe some people may think this is old fashioned, but still for theeee.... standards of our students they need that

RESEARCHER: emm

TEACHER1: ya3niii...they are not independent learners at all

RESEARCHER: ok

TEACHER1: so, we need to explain everything for them on the board

RESEARCHER: emm

TEACHER1: and let them do the exercises or examples on the laptop, it is better for them.

RESEARCHER: would it differ if they make the practice on the laptop or a piece of paper?

TEACHER1: no ... (moving the head to confirm)

RESEARCHER: do you think one is better than the other?

TEACHER1: it is only to get them used to the laptop; they need to be familiar to the laptop... but for learning they get the same amount of learning.....unless (pause) they use it find like some other links for the sake of learning

RESEARCHER: emm

TEACHER1: but this is not the standard of our students

RESEARCHER: aaaaaaaaaah ok, why you feel that the level of your students isssss

TEACHER1: wide below, to be independent...at least at the beginning of the semester...but later on.....the problem of our students, they are good but they do not have the ability how to be independent

RESEARCHER: emm

TEACHER1: we try to teach them that

RESEARCHER: ahhh ok

TEACHER1: ya3ni, I feel that, especially for the good students if we put them on the right track they will be excited about this ...

RESEARCHER: do you feel that the curriculum you teach is not prepared to using the laptops in the class? Or using the laptop does not benefit you in teaching this material?

TEACHER1: (pause) I believe that the students are not trained right from the beginning when they come to us, they are very dependent..

RESEARCHER: no what I mean is the content, like what do you teach now, lest say....ehhhhhh...how to solve equations for example?

TEACHER1: yes

RESEARCHER: this content, this curriculum

TEACHER1: but still, it is not the content the problem is with the students...before they use to go to the library to read about the certain topic....not you can use the internet to learn more...the problem is with the

students...they are not used to this...they are used to having the teacher in front of them to teach them everything.

RESEARCHER: do you think that using the laptops in your classes changed the way you teach or manage your class?

TEACHER1: ya, in a sense, ya

RESEARCHER: how?

TEACHER1: we have some technical problems, the laptop did not work, the internet is slow...what else....this is all a waste of time, which reduces the amount of teaching ...the second thing is...if you're not strong enough or tough enough the students might use the laptop for other things

RESEARCHER: ahha

TEACHER1: they do not listen to what you say, you can go around and see what the sites they open....so it is really..... You need extra time actually to give what you need to give for that period, if you are using the laptop

RESEARCHER: do you think it has made things more difficult for you? More hard?

TEACHER1: sometimes yes, yes.....it is a waste of time more likely!

RESEARCHER: how about assessments? Do you think it will make a difference if the students have the test online and no on papers?

TEACHER1: they do much better when they do the test on papers, sometimes it is the problem of the test itself, if they 1280 with a comma it might be considered as a wrong answer because of the comma, because the test was made to consider 1280 without a comma as a correct answer!

RESEARCHER: what about if you put all the questions as multiple choice questions?

TEACHER1: no, I do not believe in multiple choice questions

RESEARCHER: emm

TEACHER1: one or two questions it is ok, but not all...it does not show how much the students understand the concept.

RESEARCHER: emmm

TEACHER1: multiple choice questions, true or false, fill in the blanks are not for math we need to see the steps they followed to get the final answer.

RESEARCHER: do you feel your students like using the laptop during the math classes?

TEACHER1: no, not all the time, especially the tests they also prefer it on papers.

RESEARCHER: Thank you very much for your time.

Date: May 12, 2010

Interview with Teacher 2

RESEARCHER: for how long have you been using the laptop in your classes?

TEACHER2: for the past two semesters

RESEARCHER: how are laptops being used in your classes?

TEACHER2: just to practice, to play videos, tooo... to search for games

RESEARCHER: mathematical games?

TEACHER2: ya mathematical games, questions, worksheets

RESEARCHER: ok.....do you think it is useful for your students in learning mathematics?

TEACHER2: it is good to include technology in all subjects, but mathematically I think they should use pen and paper....andthe book also.... It is not 100% technology, laptop

RESEARCHER: why?

TEACHER2: why

RESEARCHER: why do think it should be 100% technology?

TEACHER2: look, like in English they can write paragraph, they can check it for errors...but in math it is easier for them to write on paper and to do theeeeeeeh the checking later

RESEARCHER: ehhhhhhhhhhh,... how did implementing the laptop program change the way you teach?

TEACHER2: now the students are part of the learning process, the teacher does not have to do everything for them, they can search and read and come to you and ehhh...you can discuss what they read, in a way it is a more student- centered class now...

RESEARCHER: do you think it is difficult to deal with students who use the laptop in your class?

TEACHER2: if you set your rules it is not difficult but you cannot control messaging and surfing the internet during the lesson, ya3ni you need toto keep your eyes 100% open to see what is going on...

RESEARCHER: ehhhhh how about the assessments...do you think using the laptop had a direct effect on students grades.....ahh in mathematics? Ya3ni if you do an online test....

TEACHER2: ya ...there is a gap....when you mark a paper they will get a partial mark, but because it is online...the questions are true or false or multiple choice they will not get this partial mark...so their marks are dropping.

RESEARCHER: okdo you think your students like using the laptop in learning mathematics?

TEACHER2: eh...not all of them, some of them they do, but the others do not...they prefer the explanation on the board and the teacher to do the job...with technology they need to do more effort that's why they do not like to use it that much...

RESEARCHER: thank you very much for your time.

Date: May 12, 2010

Interview with Teacher 3

RESEARCHER: how are you and your students using the laptop in your classes, for mathematics?

TEACHER3: mainly for ...revision of concepts I already taught.....some time...rarely for investigative learning and some time for blended learning

RESEARCHER: would you please elaborate more on investigative learning and blended learning?

TEACHER3: ok, for investigative learning, let's say that I want them

RESEARCHER: em

TEACHER3: to come up with the concept on their own, so maybe I give them a web-link that helps them come up with the concept I want them to learn about

RESEARCHER: ok?

TEACHER3: and blended learning when I will be teaching them through their laptops, they use it while I am teaching again it could be a web link or an activity that I designed to use their laptops

RESEARCHER: ok, do think it was useful for your students?

TEACHER3: well it was at the beginning frustrating for me and for them

RESEARCHER: is it because your students are foundation n students?

TEACHER3: ya it is because of the level of the students and also because it is the first time I am teaching with laptops so partially it is my own lack of confidence...teaching that way

RESEARCHER: ok?

TEACHER3: and technically because of the technical problem that always happen, it frustrates every one

RESEARCHER: did the college provide PDs?

TEACHER3: they did provide, but I think it should be more intensive ...and there is a lot of IT support

RESEARCHER: em

TEACHER3: but when something happen to one or two students you have to stop your class to deal with it

RESEARCHER: ok

TEACHER3: with the level of my students they cannot just let it go ... they do know how to stop focus on the lesson and carry on; they get frustrated by that little issue....

RESEARCHER: did you find it useful or you just used it for the sake of technology?

TEACHER3: I think it is useful, I think I is useful but it needs time, implementation needs time

RESEARCHER: em

TEACHER3: I think it should have been more gradual, I mean, to be honest with you, I did not use it as much as I am supposed to use it...

RESEARCHER: do you think it is difficult to deal with students having their laptops?

TEACHER3: ya definitely... with the level of my students...I think if they were trained to use it to learn through it before it would be easier for me now

RESEARCHER: ok

TEACHER3: I have students who are not motivated to learn, they use it for chat or email

RESEARCHER: how about assessment?

TEACHER3: again, it was too much too soon, but personally in math I like traditional paper and pencil exams, I like to see the steps....I like to see solutions, if they make a mistake I can see where we do not have these tools on laptops to show all of these things

RESEARCHER: did this affect their grades

TEACHER3: I did not use it a lot of assessments but ya, some of the girls who used to have high grades their marks dropped because of that....

RESEARCHER: do you think your students liked it?

TEACHER3: the assessments online?

RESEARCHER: ya

TEACHER3: no, they did not like it at all; they prefer the papers and pencil

RESEARCHER: mmm, how about the current curriculum, does it help you in implementing the laptops?

TEACHER3: I think if you have laptops in your classrooms you need to gear your curriculum towards using that medium

RESEARCHER: so you need to change the curriculum

TEACHER3: you need to change the curriculum 100%, it can be done...you have..... when you design the curriculum you have to think how I it is going to be taught...so ya

RESEARCHER: Thank you very much

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