


How Do Science Teachers, Students, and School Principals Evaluate the Availability, Connectivity, and Utilization of ICT Resources at Jordanian Schools?

Jamal ABU AL-RUZ¹, Ahmad QABLAN² 

¹ Assist.Prof.Dr., The Hashemite University, College of Educational Sciences, Zarqa-JORDAN

² Assoc.Prof.Dr., The Hashemite University, College of Educational Sciences, Zarqa-JORDAN

Received: 05.09.2010

Revised: 25.01.2011

Accepted: 15.02.2011

The original language of the article is English (v.8, n.3, September 2011, pp.14-29)

ABSTRACT

The goal of this study was to evaluate the availability, connectivity, and utilization of information and communication technologies ICT resources at Jordanian schools. Seventeen interviews were conducted with science teachers, students, and school principals in 10 public schools in Jordan. Results of the study demonstrated that all ten schools are equipped with several ICT resources but the popular use of these resources was for handling schools' administrative work, and communicating with teachers, students, and parents. However, only few of these schools utilize their ICT resources for teaching and learning. Further analysis of the data revealed five emergent themes; (a) providing better technical support solutions, (b) moving toward wireless schools, (c) emphasizing teachers' training, (d) technology empowers girls, and (e) technology motivates students and energizes classrooms. The study suggests that in order to effectively prepare Jordanian youth to participate in the networked world, greater commitments are needed from government, parents, and donors to share and adopt innovative solutions; schools need to be transformed into active learning environments; and teachers and students must be empowered to be creative agents for change in their schools.

Keywords: ICT; Availability; Connectivity; Utilization; Jordanian Schools; Science Teachers; Students; Principals; Qualitative.

INTRODUCTION

Undoubtedly, the introduction of Information and Communication Technologies (ICT) has changed lives, organizations, strategies and discourse in communities around the world (Wright, 1987; Grunberg & Summers, 1992; Fullan, 1996). Either acting as a Trojan Horse



(Olson, 1988), as a catalyst (Hawkrigde, Joworosky & McMahan, 1990; McDonald & Ingvarson, 1997) or, more recently, as a lever — a tool that must be applied purposefully to a task to be of value — (Venezky, 2002). In the education sphere, enthusiasm abounds over how computers and the Internet can bring improvement in numerous ways. Whelan (2008) states that ICT radically affects school practices, distance education, and the government and public sector policies. Due to its potential to renovate education, ICT continues to be widely recognized, countries all over the world have identified the momentous role of ICT in improving education (Kozma & Anderson, 2002; Hennessy, Ruthven, & Brindley, 2005; Goodison, 2003; Kangro & Kangro, 2004). Therefore, they have invested heavily in increasing the number of computers in schools and in the networking of classrooms (Pelgrum, 2001). In fact, schools have started to restructure their education programs and classroom facilities, in order to decrease the gap between today's and the future's teaching and learning technology. This process of restructuring demands efficient integration of ICT into existing context in order to supply learners with knowledge of specific subject areas, to encourage meaningful learning and to improve professional productivity (Tomei, 2005). As a result, various educational ICT programs have been initiated, strategies have been developed, hardware has been obtained and software has been designed.

As a response to the widespread interest in integrating ICT to improve the curriculum, pedagogy, assessment, teacher development and other aspects of the schools' culture (Roshelle, Pea, Hoadley, Gordin, & Means, 2000), Jordan has been implementing a major effort to substantially enhance the quality of school learning contexts, as well as to improve the equity of its results (Qablan, Abuloum, & Abu Al-Ruz, 2009; Al-Jaghoub and Westrup, 2003). The major components of Jordan's ICT- based reform are: reorient the education system policy objectives and teaching strategies through the governance and administrative reform, restructure and realign the education programs and practices to achieve relevant learning outcomes, achieve a universal basic education through cost effective measures, and promote readiness for learning through early childhood education (Ministry of Education, 2003).

In their evaluation report of ICT resources in Jordanian schools, Abuloum and Qablan (2008) indicate that more than 95 % of the 4600 public schools in Jordan were equipped with the ICT infrastructure. Each of these schools received computers; local networks; and educational and productivity software, and most of them have free and unlimited Internet access. However, the report indicates that the utilization of ICT resources at schools is still in its infancy and facing various obstacles such as lack of support from the school, from the Ministry of Education, and from the surrounding community (Qablan, Abuloum, & Abu Al-Ruz, 2009). To this end, the need to evaluate the availability, connectivity, and utilization of the ICT resources at Jordanian schools appears to be important in order to characterize the innovative uses of the ICT in Jordanian schools and to understand the student's characteristics and needs. This study comes to address this need by answering the following questions: How do science teachers, students, and school principals evaluate the availability and connectivity of schools with the ICT resources? How do they evaluate the utilization of the ICT resources in teaching? By answering these questions, we hope to provide essential feedback to the involved stakeholders to help them implement the second phase of the ICT based educational reform initiative.

METHODOLOGY

The purpose of this study was to evaluate the availability, connectivity, and utilization of the ICT resources at the Jordanian schools. Because it best answers the questions of what

and how, qualitative research was chosen as the study method (Bogdan & Biklen, 1998; Glesne, 1999). Taylor and Bogdan (1998) describe the uniqueness of qualitative research as a pathway to understand the interactions in their context. The rationale of employing qualitative methodology of data collection is using questionnaires that only might result in too much concentration on the product rather than the process of learning with the ICT. The most thorough types of evaluation methodology use data gathered in a variety of ways, including interviews and observations (Babbie, 2005) that enable researchers to deeply understand the phenomenon under investigation.

The multi-case study approach was used in which researchers explore a single entity (“the case”) or multiple bounded systems (multi-case) limited by activity (i.e. a process) and collect detailed information by using a variety of data collection methods during a sustained period of time (Stake, 2005). Case studies are valuable in the sense that they provide qualitative explanation consistent with the inductive model of thinking. Cases are selected in relation to their potential in contribution to reaching the research objectives as opposed to a statistical model of representation. Multiple cases for this study were purposefully selected to show different perspective, based on criteria such as the presence and pedagogical use of ICT while ensuring diversity in terms of geographic location and socio-economic factors in the middle and northern parts of Jordan.

a) Research Participants

Study participants were selected from 10 public schools. Seventeen interviews with science teachers, students, and schools’ principals were conducted in this study. Both the schools and the participants were sampled purposefully to represent the various geographic locations and socio-economic status in the middle and northern parts of Jordan. In choosing these participants, the researchers purposefully selected the participants who can provide in-depth, insightful information.

b) Data Collection

The primary source of data collection was participants’ interviews that revolved around the availability, connectivity, and utilization of the ICT resources in science teaching; the cultural and social influences that interfered with that utilization; the sort of problems they face while utilizing the ICT resources, and the suitable solutions for their problems. Seventeen semi-structured interviews were conducted. Each interview lasted for 35–45 minutes. All interviews were conducted by the two researchers, one researcher at a time and took place in the selected schools over a five months period. All interviews were recorded and transcribed for analysis (Bogdan and Biklen, 1998).

c) Data Analysis

Data collection and analysis occurred simultaneously throughout the study. Directly after each interview, all interviews were transcribed by a specialist transcriber and transformed into word format. The transcripts of interviews and observations then underwent through extensive analysis by utilizing the recent qualitative data analysis strategies that consist of three stages: (1) *open coding*, (2) *selecting themes*, (3) *focused coding* (Emerson et al., 1995).

In open coding, a within case analysis conducted, we read the data line-by-line to identify and formulate all ideas, themes, or issues the interviewees suggest, no matter how varied and disparate. After this description of themes, we focus on a few key issues (analysis of themes) to identify issues within each case and then look for common themes that transcend the cases (Creswell, 2007). Afterward, we carefully cross-checked the emerged

themes (Berg, 1995) with each participant's transcript to enable ourselves to link related data from different interviewees. Then we grouped them under one theme and marked them with accompanying interpretive notes (Berg, 1995).

In the stage of focused coding, we subjected our data to a cross case analysis, where a fine-grained, line-by-line analysis based on the issues that we identified as of particular interest from the earlier open coding analysis. In the focused stage of our data analysis, we combined the coded data under our selected themes and wrote reflective memos on each theme (Bogdan & Biklen, 1998).

Since the data collected was in Arabic, all interviews transcripts were translated into English (Sperber, Devellis, & Boehlecke, 1994) by two bilingual faculty members from the College of Educational Sciences at the Hashemite University. Furthermore, to confirm that the translation process was accurate and reflected the interviewees' meanings, each participant was given his/her written interview transcript and feedback was considered in correcting any comment from the participants.

d) Data Validation

Establishing rigor in qualitative research is a critical issue. The trustworthiness of research is an issue that should be thought about during research design as well as in the midst of data collection (Glesne, 1999). All qualitative researchers must establish a sound strategy to ensure the credibility of their results.

One means we employed to ensure the rigor of the research was prolonged engagement. We were in the research context for a prolonged period; indeed, we were in contact with our participants and visited their classrooms two to three times during the semester. In this research, we tried to communicate with our participants to build a friendly relationship with them to better engage ourselves in the environment in which they live in order to understand the kinds of difficulties they face in their utilization of the ICT resources. This prolonged engagement helped us overcome as Guba & Lincoln (1989) mention, the effects of misinformation, distortion, or presented 'fronts.' They argue, and we agree, that it is necessary to establish rapport and build the trust necessary to uncover constructions, and to facilitate immersing myself and understanding the context's culture. To allow for this "immersion," prolonged engagement was fundamentally necessary.

In addition to the prolonged engagement, we shared the tentative results of data analysis with our colleagues to help minimize our personal influences. Also, in this study, the member checking procedure was one of the most critical techniques that we used to establish credibility (Glesne, 1999) and ensure the rigor of the research. For this reason, we checked our data, (through allowing our participants to review and comment upon their interview transcripts) and our analysis (through allowing them to review and comment upon our interpretation of the data). In checking our data interpretations with our participants both during data collection and analysis, we were able to compare our interpretations and make necessary corrections and contrasts, and again report rival interpretations, if necessary. This step was very important for us to validate our understanding of data. In addition to that, we tried to ensure that our sense making was systematic and rigorous through the member check procedure that we used in this study.

FINDINGS

a) Availability and Connectivity of Schools with the ICT Resources

The analysis of collected data showed that most schools are equipped with several ICT resources. While some schools have around 40 computers, other schools have more than 100

computers. Additionally, most schools possess other related ICT peripherals, for example, data show systems, scanners, and printers. The results also indicated that only some schools (those connected via fiber optic cable network, 79 schools all over the country) have high-speed Internet connected computers available to their students' use.

We have 80 desktop computers distributed in four computer labs and more than 25 laptop computers available to use by all teachers. (School A Principal)

We have more than 40 desktop computers distributed in two big computer labs. (School B Principal)

The school is equipped with two data show systems; two display screens, one printer, and one scanner. (Zarqa School Principal)

The school has 100 Pentium 4 computers, half of them are connected to the Internet via a high speed Internet ADSL line. (School C Principal)

The school has a number of data show systems, printers, interactive electronic board, web cameras, and scanners. (School C Principal)

With respect to the internet connectivity at schools, results showed that some schools are connected to the internet via a high speed internet, via ordinary telephone lines, to enable students access the web easily.

All of our computers are connected to the Internet through a high speed internet line by wireless routers that are mounted in the large rooms and hallways. (School A Principal)

All of our computers are connected to the Internet through a high speed internet line. (School B Principal)

The school has 100 Pentium 4 computers, where half of them are connected to the Internet via a high speed internet ADSL line. (School C Principal)

In addition, schools provide each student with a personal account to access the Eduwave platform (An educational online platform established by the MoE) and to receive communications for the school administration and keep a data base to keep schools' weekly and monthly exams, students' grades on each exam, and students' information.

b) The Utilization of ICT Resources at Schools

With respect to the utilization of ICT resources at schools, results showed that most teachers are aware of the advantages that computer offers to enhance the process of teaching. One teacher, for example, explained that computer helps students understand some abstract concepts (e.g., atoms) in a much easier way than explaining it using the traditional chalk and talk teaching method. He said:

There are many advantages of using computer in teaching science; I never imagined getting my students to understand and imagine the structure of the atom. Using computer, my students learned the concept very well (Teacher Saleh Interview).

Another teacher explained two ways that can be used to teach a lesson using computer. The first way is to prepare either a PowerPoint presentation for the lesson and present it to students using a laptop and data show inside the classroom. The second way is to make a hybrid between the book and its related enrichment activities that are available either in the teacher's book or in Eduwave and present it to students in the computer lab, whenever it is available.

When asked to further elaboration on the way computer is used in teaching, one teacher describes that he begins his lesson by explaining its content to the students and then takes them to the computer lab, whenever it is available, to let them answer the Eduwave's

interactive enrichment activities that supplement each lesson. These activities, as he mentioned, help students better understand the lesson and its applications in the real world.

However, when asked about utilizing Eduwave software in teaching, both teachers and principals mentioned that the best uses of Eduwave software at schools are to handle administrative work rather than teaching. They mentioned:

We use Eduwave for various purposes; in addition to use it in teaching, we heavily use it to enter school's information, statistics, and students' grades. (Teacher Khaled Interview)

We actually don't use Eduwave in teaching; we use it only to enter our students' grades and other statistical information about the students and the school. (School B Principal)

We make use only from the additional exercises that come with the available e-content on Eduwave platform (School C Principal).

When asked to reason that, one teacher argued:

Actually the e-contents available in Eduwave are insufficient for our students, as they (the e-content) are similar to those in the books. We prefer to produce our own activities (Teacher Ahmad Interview).

Other teachers added:

I rarely use Eduwave's content in teaching my secondary course as they (the e-content) are unsuccessful. (Teacher Salam Interview).

We don't rely on the available Eduwave's content but we do prepare our own content by using flash program, dream, and PowerPoint. (Teacher Hadi Interview)

I personally tried to use our computers in teaching but we found that in addition to the old computer that we have in this school, the e-contents available in Eduwave are pretty old and the enrichment activities that the platform has are similar to those in books so we did not find a reason to use the computers. (Teacher Hala Interview)

Other teachers explained several problems that avert them from using Eduwave in teaching such as, connectivity problems, technical problems, and high class size. They mentioned:

Some teachers don't use Eduwave due to connection problems, as not all of our computers are connected to the Internet. In addition, we face problems in the big number of our students and the limited number of computers. (Teacher Mohammad interview)

I would like to use different supportive activities on Eduwave but I find it difficult to connect with the platform. The connection is so slow and I lose more than 25 minutes of my class time to open the desired page. (Teacher Lamis Interview)

Another teacher explained additional problems such as outdated computers, high students- computer ratio:

We have problems in our school's infrastructure; some of our computers are old and need to be replaced. Another problem that we face has to deal with the space of our computer labs, our computer labs should be larger and have better lights and paint. A third problem is related to the ratio of computers to students, the present ratio is 10 students to one computer. (Teacher Rana Interview)

Another teacher complained from the quality of the enrichment activities available in Eduwave, he mentioned:

Although the Eduwave has many rich activities, but I think that most of these activities are similar to those available in the book itself. I believe that these activities should be different in order to expose our students to different exercises. (Teacher Omar Interview)

Similarly, a school principal explained that the actual use of computers and software occurs only in some grades but not all grades. When asked to clarify that, he mentioned that

teachers begin preparing their students from the tenth grade for the final secondary school examination (Also called Tawjehi) because they want their students to get high scores on it. He said:

We do make use of computers in teaching the grades before the tenth grade because, the curricula are interconnected and we need to prepare our students to grasp more knowledge in order to do better in Tawjehi (Comprehensive secondary exit exam) because it is critical! (School A Principal)

The previous paragraphs demonstrated that all participating schools are equipped with several ICT resources but the popular use of these resources is for handling schools' administrative work, communicating with teachers, students and their parents. However, only few numbers of these schools utilize their ICT resources for teaching. That utilization, however, was varied. Although some schools utilize their ICT resources to teach their students the basic skills on how to use computer and Microsoft applications programs (e.g., Excel, PowerPoint), other schools put their ICT resources in the hands of their students to boost their learning by searching for relevant educational software via the Internet.

However, with respect to the utilization of Eduwave platform, almost all schools use the platform to enter their students' grades and information, which is required by the MoE. Only some schools, which have high speed internet connection, utilize e-learning content made available through Eduwave (i.e. the enrichment activities).

However, the utilization of the available e-content in teaching most curricula is narrowed on only answering the enrichment activities that accompany each lesson. This limitation in the use of the Eduwave's content was attributed, by most participants, to several reasons such as shortage in computers, poorly maintained computers, shortage in educational content, and slow Internet connectivity.

c) Emergent Themes of the Study

The previous passages demonstrated the status of availability, connectivity, and utilization of ICT resources at schools. However, further analysis of the collected data resulted in more fundamental themes, themes that may prove to be transferable to other similar situations. These themes are (a) providing better technical support solutions (b) moving toward wireless schools (c) emphasizing teachers' training (d) technology empowers girls, and (e) technology motivates students and energizes classrooms. The following passages discuss these themes in detail.

i) Theme One: Providing Better Technical Support Solutions

Jordan has done wonderful in building the ICT infrastructure in most schools. Installing computers into schools is relatively easy, yet keeping them working is a challenge. A myriad of problems ranges from software problems (e.g. computers' viruses) to hardware problems appeared throughout this study.

Our computers require ongoing maintenance as our students abuse some of them and break their peripherals. (Teacher Maha Interview)

In addition, many teachers in schools participated in this study suffered from the absence of licensed copies of antivirus to keep their computers running.

In addition, we suffer from computer viruses that enter our systems when surfing the web as well as from the flash drives that our students use. (Teacher Khaledah Interview)

Another technical problem teachers faced is the unreliable Internet connectivity, which is required to teach a lesson or to download an educational material from both the web as well

as the MoE (online learning platform (Eduwave), two teachers, Etaf and Yasir, state this issue, indicating

Some of the teachers don't use Eduwave due to problems in connectivity, as not all of our computers are connected to the Internet. In addition, we face problems in the large number of our students and the limited number of computers.

There are such problems everywhere in the world. The International Institute for Communication and Development (2007) indicates that most ministries of education all over the world are ill equipped to effectively service a large number of schools. Most schools are therefore left with very little technical support when inevitable technical glitches arise. However, a few innovative solutions have emerged in countries around the world. One solution is to give computer lab supervisors more responsibility for maintaining the computers. Many computer teachers are as or more adapt with the technology than the "professional" technicians who are often hired. Providing those teachers with some basic training and a whole lot of trust can save a school and a school system time and money. This suggestion was highlighted by many participants during our interviews:

Because of the delay in repairing our computers, we suggest that the ministry of education to allow our skilled teachers to repair small technical problems instead of wasting our time in sending our computers out to get repaired. (School B Principal)

Some of our computers take more than a semester to get repaired with the certified person from the ministry of education. Therefore, to solve this problem, giving our lab technicians some flexibility to fix our broken systems is requested because they are as skilful as certified persons. (School A Principal)

This solution, however, is currently working in discovery schools across the country. These schools have specialized persons, who are counted in the schools' staff and are in charge of repairing their schools' computers.

We actually have a specialized person who is in charge of repairing our down computers (School C Principal).

Other solutions, however, must also be evaluated, such as outsourcing this technical support to private organizations.

ii) Theme Two: Moving toward Wireless Schools

Despite the exhausting effort that the Ministry of Education in Jordan has exerted in equipping schools with ICT infrastructure, the issue of slow and unreliable connectivity was a critical problem that faces the full utilization of ICT in the science teaching. Related literature in ICT indicates that this problem is not a local problem; many schools in developing countries suffer from this sort of problems (International Institute for Communication and Development, 2007). In order to overcome the deficiencies of the existing fixed line infrastructure, some countries' schools are now bypassing their local fixed line infrastructure and establishing wireless Internet access. In Uganda, for example, there is a telling case of the schools' evolution to broader band Internet connectivity using wireless solutions. Many schools moved to a cellular telephone connection through a local company that donated one hour of free airtime per day. This allowed students to send e-mail only, at a speed of 9.5 Kbps. In order to overcome the deficiencies of the existing fixed line infrastructure and the slow data rates of the cellular telephone link, a number of schools moved to a broader band wireless connection (Uganda National Council for Science and Technology, 2002).

In this study, for example, two schools had established wireless Internet access by installing two wireless routers in the schools' hallways. The solution worked well and the schools did not suffer from problems in Internet connectivity.

We did not face any connectivity problem after connecting our school's computers to the Internet through a high speed internet line by wireless routers that are mounted in the large rooms and hallways. (Teacher Maha Interview)

Another option that the Jordan's Ministry of Education could adopt to facilitate the Internet access to all 4600 schools is to use a wireless satellite technology. This solution will serve all urban and rural schools all over the country at a reasonable cost and reliable service.

iii) Theme Three: Emphasizing Teachers' Training

The professional development of teachers sits at the heart of any successful technology and education program (Bangkok, 2004; Baylor and Ritchie, 2002; and Spillane, 1999). As indicated in the results section of this study, many teachers lack a good training on how to utilize the good educational software available in Eduwave platform.

Actually, some teachers don't have enough knowledge and skills to use the available e-content in Eduwave (School B Principal).

It is important to note that, teachers need not only formal training, but also sustained and ongoing support to help them learn how best to integrate educational software into their teaching. Training must go well beyond basic cutting-and-pasting. Teachers need to be able to transform their classrooms from places where a static one-way flow of information from teacher to student occurs, into dynamic, student-centered learning environments (Becker, 2001; Niederhauser & Stoddart, 2001) in which learners interact with peers in teams (Berner, 2003), both in their own classroom as well as with virtual classes around the world through the Internet.

Another significant role of continuous training of teachers is it alleviates teachers' fear of using technology. As it appeared in the results of this study, some teachers felt intimidated by technology and were comfortable with their own teaching styles:

Teachers don't like to use computers and their software because they are afraid of using the new stuff from overtaking their teaching role. (School A principal)

Furthermore, teachers need to be transformed from information consumers, using the Internet to access resources, into information producers, adapting the information for their particular cultural and educational reality (Bielaczyc & Collins, 1999; Carvin, 1999). Some countries have established online networks or communities-of-practice (citation is needed here), in which teachers share resources that enhance their curriculum, get peer reviews of lesson plans they have created, and exchange ideas and good practices with other teachers of their subject. These suggestions have been implemented by other countries and worked well. A physics teacher in Peru (Becerra, 2008), for example, says:

After the training, I now learn with my students and often from them. They enjoy it and I take pride in it.

In conclusion, we argue that teachers need more specific training in ways to use computers and software as well as in ways to integrate these pieces of software in their teaching. They need supporting examples of good practice (Parker, 1997), and leadership from their school principal to receive the necessary time for professional development (Anderson & Dexter, 2000), in order to truly transform teaching and learning in the classroom. ICDL and other general computer training courses do not provide teachers with the sufficient knowledge to work with computers and their software. Teachers need access to a considerable range of computer knowledge and skills in order to be able to keep up with the times and provide students with the best education possible (Dias & Atkinson, 2001).

Computers specialized courses can greatly assist teachers in delivering knowledge to students (Schmidt, 1998). Furthermore, as many educators see computers are necessary in

schools to help students develop skills on which they can build upon later, they are unwilling to use the computers within classrooms unless they received specialized training. We believe that when teachers cannot grasp all the facets of the software, they will be unwilling to use it in their courses.

Thus, the training of teachers remains a major issue in computerizing Jordanian education. It is essential to help teachers learn how to use the equipment adeptly before they can begin to introduce a more technologically-based curriculum to students. Furthermore, the Ministry of Education must make a commitment to help teachers effectively integrate computers and Internet technologies into their schools by aligning curricula, exams, and incentives with the educational outcomes that they hope to gain. Computers by themselves bring very little to the learning process—they are only tools, like many others. Linking computers and the Internet to learning objectives are challenging goals, but are the most important that education policy makers can achieve.

iv) Theme Four: Technology Empowers Girls

Among international development practitioners, female education is recognized as one of the critical factors in promoting social and economic development (Albirini, 2006). For instance, studies suggest that an educated woman is more productive at work. Furthermore, a study in Mauritania indicates that an extra year of schooling will increase a woman's future earnings by about 15 percent, compared to 11 percent for a man. Also, because women are the primary caregivers in developing countries, it is often said that, "when you educate a woman, you educate a whole family."

In this study, female students were very excited about learning by computers. They mention that learning by computers encourages them to keep the information longer:

Learning by computers is a better way than using traditional learning strategies. It (computer) encourages us to retain our information longer. (Student Basem Interview)

We are very happy; we feel that we are learning more. Computer is a very good tool to encourage learning. (Student Ali Interview)

Their excitement to learn by computers helped them advance their academic achievement. Several students mention that they love using computer's software to prepare a lesson and present it to the class:

Computer encourages us to prepare our lessons before we come to the class. We were not doing that before introducing computer to our school. We like to use the computer and its software to prepare a presentation for our class. (Student Yamen Interview)

The Computer advanced our academic achievement. We feel that our lessons became joyful. (Student Housam Interview)

These results were also observed throughout our schools and classrooms' observations. It was very obvious to us that female students show more interest to learn by computers than their male counterparts.

Another interesting observation was the way how computers help our students gain their freedom. Several students indicated that they get their total freedom to learn from the diverse information available on the Internet.

We get our freedom from the Internet, since in our society girls are not allowed to go wherever they want...the Internet takes us out to other people, places and realities...it is our way to go out. It is vital to us, it gives us liberty. (Student Ali Interview)

These conclusions were echoed by the conclusions of several international studies. A recent study on the differential impact of using ICT on boys and girls showed that in areas such as academics and communication skills, girls have benefited more, while in the area of

technological skills, boys have benefited more (Hayward, Alty, Pearson, & Martin, 2003). Moreover, once online, girls appear to do extensive research on teen-related information that is often taboo in their cultures, such as sexually transmitted diseases, teen pregnancies, and HIV and its prevention. For example, 70 percent of girls in schools in Mauritania for instance, emphasize the fact that the Internet provides freedom to them as women since they no longer need to limit themselves to the controlled information given by their society and family. Another girl from Ghana states, “Our self-esteem has really improved because of the computers. Now we can rub shoulders with boys that want to step on our toes. We walk with our chests out! Anytime we are confronted with questions we feel confident answering, even with older people we come boldly!”

v) Theme Five: Technology Motivates Students and Energizes Classrooms

When schools are connected to the Internet, both teachers get encouraged to rethink their teaching methods, and students to get trained to use technology. Teachers quickly see how the use of computers energizes the students and makes the classroom a more interactive learning environment.

Throughout our interviews and classroom observations, we noticed that most teachers and students are so eager and motivated to use the computers and surf the web seeking valid and rich information.

A similar case was also found with schools' administrations. According to what they recounted during their interviews, teachers mention that before the introduction of the ICT, the students in most science classes were usually treated as passive recipients of information, whereas the teachers' role was authoritative that to convey the required information to students. At that time, the intention of science teachers was to maximize cognitive development. Students were required to do advance reading before class, listened to lectures in class, and did homework after class. At the end of the academic year, students were required to set for a final examination to determine their final scores.

When the ICT was initially introduced, science teachers were the leaders to employ it in their teaching, where PowerPoint presentations, Microsoft Word, and Simulation programs were the most used software by teachers and students:

After the introduction of the ICT, we depend on the Internet to find some helpful simulation programs that help our students better understand their lesson (for example the type of movement of electrons, the power of gravity...etc) (Teacher Etaf Interview)

My students and I find learning by using the ICT as a joyful and a helpful activity. It helps my students retain their information longer and enables them to apply it in their real life situations. (Teacher Maha Interview)

These results were also shown in the literature. Several studies showed the impact of using the ICT on students' attitudes toward schools (Somekh, Lewin, Mavers, Fisher, Harrison, Haw, & Lunzer, 2002). For example, a teacher in Peru (Becerra, 2008) said, “I learned to break the routine of using the chalk and the blackboard. Computers forced me to make my classes more interesting, more tangible—students are more interested and attentive.”

Teachers have also reported that ICT helped students develop confidence, a sense of responsibility, the ability to work as team members, think creatively for solutions, and share knowledge (Kozma 1999). In a focus group of teachers in the Palestine Authority, the greatest benefit of the use of computers was that it broke down the barriers between teachers and students in the classroom (Economic and Social Commission for Western Asia, 2007). As one Palestinian teacher stated, “There is now a more collegial environment and less hierarchy—students feel comfortable asking teachers questions and teachers are less intimidated to seek help from students.”

Many teachers, however, initially feel threatened by the loss of control in the classroom as students, who are usually more adept at using technology, can quickly access information and challenge the teacher's role as the sole font of information. Teachers who receive professional development, however, learn how to more effectively manage their classes and use the technology to create a more stimulating learning environment (Bangkok, 2004; Baylor and Ritchie, 2002; and Spillane, 1999).

CONCLUSIONS and RECOMMENDATIONS

The ICT based educational reform project in Jordan is fruitful and moving in the right direction with the help and support of all involved stakeholders. The incorporation of the ICT into the learning system, in five years, has led in changing the way teaching and learning that is happening at schools. Participants in this study have been greatly empowered, and now believe they can compete in a global knowledge-based economy because they know that their knowledge, ideas, culture, and passions are as valuable as any others in the world. However, in order to more effectively prepare its youth to participate in this Networked World, greater commitments and willingness to share and adopt innovative solutions are needed from all aspects of society; from the government, the private sector, communities, donors, parents, and students. Schools need to be transformed into active learning environments open to their communities; telecommunication and power infrastructure policies should focus on schools as starting points for rural transformation; teachers and students must be empowered to be creative agents for change in their schools; and leaders must embrace a vision that will prepare their youth for tomorrow's challenges.

The issues outlined in this paper are not unique to Jordan, instead, schools around the world face the same challenges. Thus, it is time to collectively change our approach to the learning process, and particularly, take advantage of the power of technology to improve learning outcomes, enhance economic opportunities, foster greater creativity, and realize the dreams of disadvantaged youth in Jordan and other countries. If together we can begin this transformation, a hundred years from now schools will sit at the heart of a learning society and allow youth from any country in the world—rich or poor—to have the same opportunities to create a better world. (In my opinion, this last paragraph goes beyond the intent of this paper. Authors may want to keep their discussion within the framework of the study. Hundreds year later, many may argue that “schools” will not exist as we have them now. It's better to be realistic and not making big claims about the future.)

REFERENCE

- Abuloum, A. & Qablan, A. (2008). *Evaluation of ICT Resources Provision, Access and Utilization*. A national report prepared for the World Bank and the National Center for Human Resources Development (NCHRD). Amman, Jordan. Retrieved from <http://www.moe.gov.jo/>.
- Albirini, A. (2006). Teachers' attitudes toward information and communication technologies: the case of Syrian EFL teachers. *Computers & Education*, 47, 373-398.
- Al-Jaghoub, S. & Westrup, C. (2003). Jordan and ICT-led development: towards a competition state? *Information Technology & People*, 16(1), 93-110. doi: [10.1108/09593840310463032](https://doi.org/10.1108/09593840310463032).
- Anderson, R. E., & Dexter, S.L. (2000). *School Technology Leadership: Incidence and Impact*. (Teaching, Learning, and Computing: 1998 National Survey Report#6). Irvine, CA: Center for Research on Information Technology and Organizations, University of California, Irvine.
- Babbie, E. (2005). *The practice of social research*. Belmont, California: Wadsworth.
- Bangkok, U. (2004). *Integrating ICTs into Education*. Retrieved August 12, 2010, from ICT in Education: <http://www.unescobkk.org/index.php?id=1793>
- Barker, P. (1999). Using intranets to support teaching and learning. *Innovations in Education and Training International*, 36(1), 3–10.
- Baylor, A. L., & Ritchie, D. (2002). What factors facilitate teacher skill, teacher morale, and perceived student learning in technology using classrooms? *Computers & Education*, 39, 395–414.
- Becerra, O. (2008). *ICT and Systemic Reform Case Study: Systemic Reform in a Developing Economy Perú*. Ministry of Education of Peru.
- Becker H. J. (2001). *How Are Teachers Using Computers for Instruction?* Paper presented at the 2001 Annual Meeting of the American Educational Research Association, Seattle, March 2001.
- Berg, B. (1995). *Education, cultural myths, and the ecological crisis: an introduction to theory and methods* (3rd Ed.). Needham Heights, MA: Allyn & Bacon.
- Berner, J. E. (2003). *A Study of Factors That May Influence Faculty in Selected Schools of Education in the Commonwealth of Virginia to Adopt Computers in the Classroom*. (Abstract Doctoral Dissertation, George Mason University, 2003). *ProQuest Digital Dissertations* (UMI No. AAT 3090718).
- Bielaczyc, K., & Collins, A. (1999). Learning Communities in Classrooms: A Reconceptualization of Educational Practice. In: C. Reigeluth (Ed.), *Instructional-design theories and models. A new paradigm of instructional theory*, (vol. 2, pp. 269–292). Mahwah, NJ: Lawrence Erlbaum Associates.
- Bogdan, R., Biklen, S. (1998). *Qualitative research for education: an introduction to theory and methods*, 3rd edn. Allyn and Bacon, Needham Heights.
- Carvin, A. (1999). Technology Professional Development for Teachers: Overcoming a pedagogical digital divide. *The Digital Beat*, 1(16), 1-5. Retrieve August 24, 2010, from: <http://www.benton.org/DigitalBeat/db093099.html>.
- Creswell, J. (2007). *Qualitative Inquiry and Research design: Choosing among Five Approaches*. ThousandOaks, CA: Sage publication.
- Dias, L.B., & Atkinson, S. (2001). Technology Integration: Best Practices Where Do Teachers Stand? *International Electronic Journal for Leadership in Learning*, 5(11).
- Economic and Social Commission for Western Asia (2007). *National Profile of the Information Society in Palestine*. United Nations.

- Emerson, R. M., Fretz, R. I., & Shaw, L.L. (1995). *Writing ethnographic fieldnotes*. Chicago, IL: The University of Chicago Press.
- Fullan, M.G. (1996). Implementation of Innovation. In *International Encyclopedia of Educational Technology*. (eds. T. Plomp & D.E. Ely) pp. 273–281. Elsevier Science/Pelgrum, Oxford.
- Glesne, C. (1999). *Becoming qualitative researchers: an introduction*. Wesley Longman, Inc., Eddison.
- Grunberg, J. & Summers, M. (1992). Computer innovation in schools: a review of selected research literature. *Journal of Information Technology for Teacher Education*, 1, 2, 255–276.
- Goodison, T. (2003). Integrating ICT in the classroom: a case study of two contrasting lessons. *British Journal of Educational Technology*, 34(5), 549-566.
- Hayward B, Alty C, Pearson S and Martin C (2003) Young People and ICT 2002. A report to the DFES. ICT in Schools Research and Evaluation Series No 12. Coventry: Becta. www.becta.org.uk/research
- Hawkrige, D., Joworosky, J. & McMahan, H. (1990). *Computers into third-world schools. Examples, Experiences and Issues*. McMillan, London.
- Hennessy, S., Ruthven, K. & Brindley, S. (2005). Teacher perspectives on integrating ICT into subject teaching: commitment, constraints, caution, and change. *Journal of Curriculum Studies*, 37(2), 155-192. doi: 10.1080/0022027032000276961.
- International Institute for Communication and Development. (2007). *People - ICT – Development*. The Hague, The Netherlands.
- Kangro, A. & Kangro, I. (2004). Integration of ICT in Teacher Education and different school subjects in Latvia. *Educational Media International*, 4(1), 31-37. doi:10.1080/0952398032000105076.
- Kozma, R. (1999). *ICT and educational reform in developed and developing countries*. Centre for Technology in Learning Menlo Park, CA: SRI International.
- Kozma, R. & Anderson, R. E. (2002). Qualitative case studies of innovative pedagogical practice using ICT. *Journal of Computer Assisted Learning*, 18, 387-394. doi: 10.1046/j.0266-4909.2002.00250.doc.x.
- McDonald, H. & Ingvarson, L. (1997) Technology: a catalyst for educational change. *Journal of Curriculum Studies*, 29, 5, 513–527. doi: 10.1080/002202797183883.
- Ministry of Education. (2003). *Education Reform for Knowledge Economy*. Ministry of Education, Amman. Retrieved from <http://www.moe.gov.jo/>.
- Niederhauser, D. S., & Stoddart, T. (2001). Teachers' Instructional Perspectives and Use of Educational Software. *Teaching and Teacher Education*, 17, 15-31.
- Olson, J. (1988) *Schoolworlds/Microworlds: Computers and the Culture of the Classroom*. Pergamon Press, Oxford.
- Parker, R. D. (1997). Increasing Faculty Use of Technology in Teaching and Teacher Education. *Journal of Technology and Teacher Education*, 5 (2/3), 105-115.
- Pelgrum, W. (2001). Obstacles to the Integration of ICT in education: Results from a worldwide educational assessment. *Computers & Education*, 37, 163-178. doi:10.1016/S0360-1315(01)00045-8.
- Qablan, A., Abuloum, A., & Abu Al-Ruz, J. (2009). Effective Integration of ICT in Jordanian Schools: An Analysis of Pedagogical and Contextual Impediments in the Science Classroom. *Journal of Science Education and Technology*, 18 (3), 291-311. doi: 10.1007/s10956-009-9151-9.
- Roshelle, J.M., Pea, R.D., Hoadley, C.M., Gordin, D.N. & Means, B.M. (2000) Changing how and what children learn with computer-based technologies. *Children and Computer*

- Technology*, 10, 2, 76–101. Retrieved from http://futureofchildren.org/futureofchildren/publications/docs/10_02_03.pdf.
- Schmidt, D. (1998). Technology and Teacher Education: Pre-service Teachers Can Help Make a Difference. *Journal of Computing in Teacher Education*, 14(2), 2-3.
- Somekh B, Lewin C, Mavers D, Fisher T, Harrison C, Haw K, Lunzer E (2002) *ImpaCT2: Pupils' and Teachers' Perceptions of ICT in the Home, School and Community*. A report to the DfES. ICT in Schools Research and Evaluation Series No.9. Coventry: Becta. www.becta.org.uk/research
- Sperber, A., Devellis, RF. & Boehlecke, B. (1994). Cross-cultural translation: methodology and validation. *Journal of Cross-Cultural Psychology*, 25(4), 501–524. doi: 10.1177/0022022194254006.
- Spillane, J.P. (1999). External Reform Initiatives and Teachers' Efforts to Reconstruct their Practice: The Mediating Role of Teachers' Zones of Enactment. *Journal of Curriculum Studies*, 31(2), 143-175.
- Stake, R.(2006) .Multiple Case Study Analysis. New York: Guilford Press.
- Tomei, L. A. (2005). *Taxonomy for the Technology Domain*. USA: Information Science Publishing.
- Taylor, S., Bogdan, R. (1998). *Introduction to qualitative research methods: a guidebook and resource*. Wiley, NY.
- Uganda National Council for Science and Technology. (2002). *Status of ICT in Uganda*. Kampala, Uganda.
- U.S. Department of State. (2009). Background Note: Jordan. Retrieved June 11, 2009 from: <http://www.state.gov/countries/>
- Venezky, R.L. (2002) *Quo Vademus? The transformation of schooling in a networked world* [Research Report]. OECD/CERI, Paris. www.oecd.org/EN/documents/0,EN-documents-4-nodirectorate-no-28-no-4,00.html.
- Whelan, R. (2008). Use of ICT in education in the South Pacific: findings of the Pacific eLearning Observatory. *Distance Education*, 29 (1), 53-70. doi: 10.1080/01587910802004845.
- Wright, A. (1987). The process of microtechnological innovation in two primary schools: a case study of teachers' thinking. *Educational Review*, 39, 2, 107–115. doi: 10.1080/0013191870390201.