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Crossing the digital divide: ICT implementation in the Al-Ula District

Fahad Albalawi

General Directorate of Education in Madinah

foa1441@gmail.com

Abstract. This study investigated the use of information and communication technology (ICT) within the Al-Ula school district of Saudi Arabia. Participants for this study were teachers and principals in the Al-Ula school district who had experience using ICT within their schools. Data consisted of interviews with these participants, which were analyzed qualitatively. The central question of this study was: What do teachers and principals identify as the challenges to implementing educational technology in Al-Ula schools? Findings showed multiple barriers to ICT implementation at the organizational, practical/material, and individual level, including a lack of resources, training, policy, and plan for ICT implementation.

Keywords. Information and communication technology (ICT), change implementation processes, education in Saudi Arabia, instructional uses of ICT, Al-Ula school district

Introduction

While the Kingdom of Saudi Arabia (KSA) as a whole is advanced in its use of technology, schools in small cities such as Al-Ula have not yet fully developed their educational technology capabilities. In many smaller cities and remote areas, schools have lower student populations, and therefore a reduced amount of funding for these schools is made available from the Ministry of Education. This, in combination with fixed costs for all schools (e.g., power, insurance, basic staffing), limits the amount of room in the budget for ICT, leaving smaller schools with fewer resources relative to larger urban schools (Sundeen & Sundeen, 2013).For the KSA to stay globally competitive and relevant, it should incorporate information communication technology (ICT) in its secondary schools (Oyaid, 2009). Technology enhances the learning process by making it both accessible and understandable to students, improving the education level of the student and the teacher (Alshammari, 2014). Despite significant social and cultural progress over the last 30 years, teaching in the KSA is still done primarily with traditional pedagogical methods, especially in rural and more remote areas and at the earlier grade levels. An advanced education technology infrastructure is necessary to develop a technology-based curriculum, which has the potential to be more effective than traditional pedagogical methods (Kalonde, 2017).

The Saudi population in educational institutions under age 20 has increased by 48.57% in the past 10 years, resulting in overcrowding of classrooms and a reduction in the quality of learning. There is a strong relationship between the need for e-learning and Saudi population growth because much of the population lives in remote areas, where students might not have

access to educators; female students, especially, come from traditional and conservative rural areas where families do not want to send their children (especially their daughters) away to further their education (Al-Asmari & Rabb Khan, 2014).Additionally, people in small villages and students who do not have access to technology might be excluded from the larger world and the ability to engage in the global marketplace (Alwani & Soomro, 2010).

The Ministry of Education (2019) has stated that knowledge and information will be more important than material wealth as a means of economic development in the future, so the KSA's goal is to transition to a knowledge-based economy and to take a more globally prominent position. KSA intends to accomplish this through e-learning and distance learning (Ministry of Education, 2019). KSA has established the National Center for e-Learning and Distance Learning (2019), which states clearly: "The National Center for e-Learning is responsible for implementing education, information and communication technologies to improve the efficiency of the educational and training process in all its forms and control its quality" (para. 1). The National Center for e-Learning and Distance Learning further seeks to foster and support excellence in teaching and learning, by implementing IT and other technology systems in ways that improve communication and helps to achieve the nation's goals.

This emphasis on education also has an e-learning component that has not been fully developed or organized. In 1959, the Ministry of Education established a small audio-visual unit. This introduced a new method of instruction design and software production, along with improving access to the public via radio and television stations. The Ministry established the General Administration for Educational Technology within the Educational Development Department in 1985 in order to introduce education technology policies on design and implementation (Alqarni, 2015). KSA began using computers in teaching and learning in the 1990s. In 1996, the Ministry of Higher Education established the Computer and Information Center to design a new curriculum and develop technological capabilities in both students and teachers. E-learning began in KSA around 2002 and has gained momentum in academic institutions at a slower pace than other countries. In 2002, the government began to create policy for technical education and training, establishing an e-learning resource center and an e-library (Al-Asmari & Rabb Khan, 2014).

The government provided schools with computers and software starting in elementary school as early as 2006. Software was in Arabic and used specific programs to teach Islamic studies, math, and social studies (Ministry of Higher Education, 2006). Even with these good intentions, in 2008 theorists claimed that ICT in KSA was still in its infancy. Saudi Arabia adopted a national plan to develop information technology across the country (Alqarni, 2015). The Ministry of Higher Education launched the Google Educational Program, which involved more than 200 schools and 20,000 teachers, who were provided with emails and access to personal websites. The Ministry of Higher Education also worked with Intel and Microsoft to establish educational training and learning programs for students and teachers (Al-Asmari & Rabb Khan, 2014).

Research shows that students using technology in the classroom improve their learning (Alshammari, 2014). However, integrating technology in KSA schools has been limited due to a lack of hardware and reliable internet access during the school day. Numerous KSA schools have only a few computers (Al Mulhim, 2014). These are serious financial and technological issues that need to be addressed to successfully implement an ICT learning environment; however, problems keeping up with technology and training, as well as the corruption of files and viruses and outdated hardware are all issues that need to be addressed. Another central problem is a lack of training or consistent policy from the government that could help build a

solid infrastructure. As Al-Asmari and Rabb Khan (2014) noted, academic institutions do not provide the basic tools necessary for e-learning. Many issues are related: students need teachers to be educated and trained, while teachers need to feel comfortable and supported by the administration and a local infrastructure. The institutions in Saudi Arabia lack understanding of the best practices and procedures to solve their educational technology problems.

Barriers to ICT implementation could be both school-related and teacher-related, but some of the strongest barriers may be teachers' attitudes toward technology and their resistance to change, their lack of time, their lack of confidence using technologies, as well as a lack of knowledge or training (Albirini, 2006; Pall & Batra, 2016). Schools in many regions have been shown through research to have barriers to ICT, including a lack of access to technology, minimal training and technical support, as well as lack of funds for hardware and software for the school district or the school itself (BECTA, 2004). Without proper training, support, and equipment, teacher morale will be low, and therefore, the chance of using these new technologies will be low. "The problem of lack of effective training is reported by many Saudi researchers and other Arabic researchers as a major obstacle to using technology properly in classrooms" (Al Mulhim, 2014, p. 489). In many remote areas, schools are seen to have smaller student populations, and therefore a reduced amount of funding available. This, in combination with fixed costs for all schools (e.g., power, insurance, basic staffing), creates a narrower amount of room within the budget for technological advancements (Sundeen & Sundeen, 2013).

If teachers do not feel confident or prepared when using technology, they could feel incompetent or feel criticized in front of their students (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). A teacher might know his or her subject matter quite well, but if they are unable to use technology, that will not only undermine their authority with students. This fear of failure contributes to the resistance teachers feel about implementing technologies in their classrooms:

Teachers' fear of failure is reinforced by failure to use IT successfully. The more a teacher internalizes previous failures, the less likely it is that he/she will be able to solve new compatibility issues. The more demands there are on teachers to make IT work in the classroom, the more fear of failure. (Alwani & Soomro, 2010, p. 37)

ICT is imposed by policy, but the policy does not properly address teacher training or training resources. Teachers may also exhibit cultural resistance, while feeling helpless in relation to their personal educational approaches or philosophies (Oyaid, 2009).

Some teachers in remote regions may have not learned the basic fundamentals of technology use, such as how to operate a computer or set up a printer (Al Mulhim, 2014). This illustrates the fact that these remote teachers must undergo more significant basic training to meet the needs of their students in using technology. Teachers in many studies have a moderate user level knowledge of technology; however, when asked to apply this knowledge to an educational setting for deliberate and intentional use of ICT with instruction, many feel as if they lack the adequate knowledge and training (Asan, 2003). This is another reason why effective sustained policy with regards to teacher training and implementing technologies in a learning environment is essential for teacher success. Success will depend upon teachers feeling confident using the technology, which will help students view the teacher as an authority in teaching with technology. This will reinforce their ability to teach subjects with competency, especially to students who might be more familiar with new technologies than their teachers (Alwani & Soomro, 2010).

This issue of technology education is not restricted to KSA rural regions, as many studies have also shown difficulty in other parts of the world, including the United States (Howley, Wood, & Hough, 2011; Vareberg, 2016). In Howley et al. (2011), it was seen that

there were significant problems with technology integration stemming from teachers' educational beliefs and philosophy and teachers' knowledge in rural versus more populated regions. The problem in KSA is more pronounced in smaller towns or rural areas where there is limited access to technology and computers, as well as technology training and education. Change cannot be possible without a commitment from the Ministry of Education and the investment of resources to supply technology products for e-learning as well as training for teachers (Al Mulhim, 2014). Because many remote areas have more difficulty finding trained teachers and the budgets to support buying ICT for learning (Alshammari, 2014), a possible solution could be found in the development of a training infrastructure on-site within the towns or villages or those school districts so that any problems that arise can be managed through instructional support. To get educators and students comfortable using the technology, teachers need a direct hands-on approach to be instructed in training and motivation to implement technologies (Al-Asmari & Rabb Khan, 2014).

Significance of the Study

This study is significant to research and practice in field of education, both in Al-Ula schools and in other similar contexts. For the field of education, this study has the potential to advance research into the implementation of ICT, especially in small city and/or developing parts of the world. Though there is a substantial existing body of research on ICT implementation in education, much of it has not been focused on small cities and remote areas in Saudi Arabia or throughout many parts of the world. With this in mind, it is useful to collect data in small areas such as Al-Ula in Saudi Arabia. In addition, most of the existing literature on ICT implementation is quantitative and/or survey-based, and the perspectives of professionals worn in schools in more remote areas have not been featured prominently in the literature. Therefore, a study that focuses on the perspectives of professionals (the teachers and principals working in these schools) can contribute to our current understanding of the challenges that these professionals face and ways of overcoming those challenges. For researchers in education, the insights offered by these perspectives could augment the knowledge currently found in the literature, and potentially open up new lines of inquiry for future research.

For educators, this study may also offer significant practical applications. Because this study is focused on the challenges that educators face in implementing ICT and how they might be overcome, this study may offer guidance to other educators. Educators currently working in schools similar to the study sites might be able to better recognize the challenges their own schools face through comparing/contrasting their own institutions with those in this study, offering educators a set of best practices to follow (along with pitfalls to avoid) when implementing ICT at their own schools. Additionally, this study will include an examination of KSA policy and its influence on local school policy and practice. Thus, it may offer insight to policy-makers working at the system level as well as local-level educators who hope to advocate for better ICT implementation policy and practice.

In order to examine the use of ICT in Al-Ula schools, this study focused on a primary research question: What do teachers and principals identify as the challenges to implementing educational technology in Al-Ula schools?The purpose of this study was to identify the specific barriers to implementing ICT and recommend possible ways to improve the quality of e-learning in Al-Ula and similar school districts.

Methods

The 18 schools sampled for this study included only boys' schools from the Al-Ula school district: 9 primary schools, 5 middle schools, and 4 secondary schools. These schools were selected, in part, because of the researcher's access to them. All schools selected for the study had internet access for their teachers and each location had similar availability of their ICT components, allowing the study to have a focused examination of the same ICT experiences.Within these schools, 10 teachers and 4 principals were interviewed. The participants were male, ranging in age from 33-50. The telephone interview protocol wasadaptedfrom "Developing a Strategic Approach to ICT Implementation in Saudi Secondary Schools"by Albugami (2016), with minor adaptations to fit the parameters of the current study. The thematic elements within the instruments included teacher perceptions of ICT, training programs and processes, and infrastructure and capacity elements of the ICT implementation process. The semi-structured telephone interviews were 30-45 minutes long, and were audio-recorded. These recordings were then hand-coded and analyzed to discover common themes among the participants. Pseudonyms were used in place of actual names to maintain participant confidentiality.

Findings

Positive Attitudes Toward Technology

As Tearle (2004) pointed out, one of the primary factors in implementing change in ICT use is the attitude and motivation of the users. In order for change to be effective, users must believe that its use will offer significant advantages over other methods, and they should have confidence that they have the necessary resources to use technology. Data from this study showed that teachers and principals had an overall positive attitude toward the advantages that ICT offered them. As Ahmad, a middle school teacher, pointed out:

The best way to use learning technology to teach for several reasons facilitates the teaching process for the teacher and the learner and facilitates the delivery of information with the least effort and time in a smooth and enjoyable way - motivates students to social work as groups - facilitates the speed of the student and the teacher to obtain the information through research and obtain the information from its reliable sources.

Ahmad's comments demonstrated a belief that there are multiple advantages to using technology. This teacher implied that the entire teaching process was not only made more effective and efficient through the use of ICT, but that it was more enjoyable as well. In addition, this teacher believed that ICT could help students work together in groups, suggesting that ICT facilitated a collaborative learning environment. Fellow middle school teacher Hamdan also noted that "with this generation, I prefer to use educational technology to teach, because we are in time of cognitive explosion and some students may get bored of using the traditional method." As Hamdan suggested, he preferred to teach with technology as students who had become more accustomed to technology use could become bored with traditional teaching methods. Throughout the interviews, teachers echoed these motivations for using technology, and demonstrated that they have a positive attitude toward technology use. The principals who were interviewed also had a consistently positive attitude toward technology use. For example, primary school principal Salem stated "the use of technology has become necessary to keep up with the development in the learning process. The use of technology gives the teacher more room to communicate information to students than the traditional method." With this perspective in mind, it is reasonable to assume that this principal would be highly supportive of teachers using ICT.

Dissatisfaction with Technology Implementation

On the other hand, the interview data suggested that the views toward technology implementation are not entirely positive. It is worth noting that every person interviewed, both teachers and principals, stated that they were not satisfied with the current status of technology implementation at their school. For example, primary school principal Osama stated that he was "certainly not satisfied at all" with ICT use at his school.Interviews with principals support the notion that resistance to change was not a common phenomenon in the schools, as those who commented on it noted that the teachers who resisted technology use were the exception to the rule. As Osama noted, "some older teachers do not prefer to use technology. I have three teachers in my school that say they are not satisfied with using technology in classroom." While widespread resistance to change can be a barrier to ICT implementation, it is reasonable to assume that unanimous support for change within a school, while likely nearly impossible to achieve, is not necessary.

Inadequate or Obsolete Technology

Al-Ula schools appeared to be equipped with a range of technology, and most teachers appeared to have regular access to that technology. At the same time, the teachers and principals who were interviewed for this study pointed out that the technology they had access to was inadequate or obsolete. Nearly everyone interviewed noted that the internet was too slow for their needs. As Nader, a primary school principle, noted, "In my school internet is slow. This is a major hindrance in my school.All teachers complain about it." Middle school teacher Abboud expanded on this problem a bit further when he said, "Internet is slow and this is one of the most important obstacles to using technology in the school, for example, sometimes I cannot use Google to search or YouTube clips because of the weak internet. It takes time for the search page to open." From these responses, it appears that the internet was not just a little bit slow, but slow enough that using the internet as an instructional tool is not possible. It also appeared that this problem is causing some frustration among teachers, which could eventually affect their motivation and willingness to implement ICT.

In addition to the slow internet connection, participants noted that the hardware and software did not operate efficiently. As Osama stated: "The computer lab is old. For example, the computers in the computer lab are old and do not accept the update. For example, Windows 10 cannot update the devices because they are old. You know that the possibilities for schools are very limited." Ahmad shared a similar sentiment when he said, "All computers including hardware and software are old. We cannot update them." Across the interviews, most teachers and principals noted that the hardware and software were out of date, resulting in compatibility issues between software and hardware, problems updating systems, and an overall lack of efficiency. These findings support those of Al Mulhim (2014), who noted the negative impact of limited access to reliable computer technology on attempts to implement ICT in Saudi Arabia.

Lack of Financial Support/Lack of Resources

One logical explanation for the inadequate or obsolete technology was a lack of financial support from the Ministry of Education. As computer hardware and software can be costly and become obsolete when outdated, this was clearly an issue of concern among principals. For example, Salem stated that there was a "lack of financial resources from the Ministry, meaning the school budget is not enough to buy computers for the number of students," a statement echoed by Salem whenhe said, "the Ministry of Education has not equipped and provided classrooms technologies." According to these principals, they have inadequate supplies of

technology, as not received either the equipment they need or funds to purchase the equipment themselves from the Ministry.

Lack of Maintenance and/or Technical Support

Perhaps related to obsolete or inadequate hardware and software, participants in this study frequently pointed to a lack of maintenance and/or technical support as a problem that hindered ICT implementation. In most cases, it appeared that there was no one on staff at the school whose role was to provide that support. As Nader stated:

There is no technical support in the school sometimes the internet is broken and we do not know how to fix the problem so we contact the maintenance department and send a technician to fix the problem. The technician takes about two weeks to come to the school and repair the equipment. In addition, sometimes some devices in the middle of the semester fail, and it takes time to request technical support to repair the devices, and this is one of the challenges that hinder the use of technology in the school due to the lack of a technician in the school. Sometimes some teachers ask a technician at his own expense and pay for it.

In this statement, Nader points to several problems with technical support and maintenance at the school. First, the technician was located somewhere off-site, and the work request took two weeks to fulfill, meaning the technology was not in use during that time. Second, if the technology broke down in the middle of the semester, any instruction that might have happened with that technology would be prevented or delayed. And third, teachers were sometimes required to pay for technical support out of their own pocket, which should not be their responsibility. Sultan, a middle school teacher, brought up very similar issues when he said:

There is no maintenance inside the school for the devices and no technical support. If a device break down, I will request technical person from the maintenance department but technical takes a week to come to my school. Sometimes he cannot fix the device because there are no spare parts available for the device.Last year I repaired devices from my own money.

In addition to the length of time it took to get technical support, the support this teacher eventually received was sometimes inadequate, as the technician was not properly equipped to fix the device. For lack of a technician on staff also meant that the ICT was not getting the kind of maintenance that might prevent failures from occurring in the first place, and might also extend the life of technology and take longer to become obsolete.

Lack of Strategic Planning for ICT Use

In the interviews, principals were asked about their involvement with technology, especially as it pertained to their role as an educational and instructional leader on their campuses. All of the principals displayed positive attitudes toward technology use, often appearing to view themselves as motivators or role models for technology use. However, beyond their role as motivators, they did not appear to have a clear strategic plan in their approach to ICT implementation. For example, Osama stated, "The role that I play in my school as an educational leader is to bring my laptop with me every day. Encouraging teachers and students to use technology in school. I repair and some devices in my school and buy some projectors from my own money." Based on this response, this principal placed value on his role of encouraging the use of ICT, though his method of doing so was passive (i.e. "bringing his laptop" every day). Other than that, he also acted as a substitute for technical support, and paid for resources outside of his budget. Neither of these actions would normally fall under his role as a school leader.

Salem took the role of encouraging computer use a step further, stating that he "gave giving awards to teachers who use technology continuously, and I am also evaluating the

teacher for using class technology." For Salem, it appeared that encouraging technology use meant using more of a punishment/reward system, with teachers who used technology receiving awards, while those who do not might get a negative evaluation. Like Osama,Salem demonstrated a high level of support for teachers using technology, but also offered additional rewards and incentives (i.e. awards, positive performance evaluations). At the same time, while both Osama and Salem were personally support of ICT, neither mentioned a clear schoolwide strategic plan or initiative that would provide institutional support for ICT use among teachers. This theme emerged in the interview data collected from each principal, like secondary school principal Tarek, who stated that he:

Created a special site for the presence and absence of teachers and students, and for all activities within the teacher, approximately 50% of the teacher's work on this site. All devices and batteries in the classrooms are teachers and educational leader. In addition, in the school we were able to train teachers who need improvement in their skills. I try to do everything I can to develop the educational process.

While not tied to a strategic plan, this principal was clearly more actively involved in providing institutional support for ICT use, and he appeared to be trying to address some of the challenges that arose with ICT implementation.

Lack of Clear Direction from the Ministry

While none of the principals appeared to have a clear strategic plan for technology use in their schools, one explanation for this finding could be a lack of direction or policy from the Ministry of Education. The principals interviewed noted that there was no clear governmental policy for technology use. Salem noted that, as it pertained to ICT use, "The education policy is unclear," a statement supported by Osama when they said the policy was "not clear and we have not received any official document regarding the use of technology by teachers or the obligation of teachers to use it in school."

It appears that principals have not received clear direction, support, or official policy from the Ministry as it pertains to technology use. This has potentially created a situation in which principals lack the direction needed to develop a strategic plan to implement technology use in their schools. These findings support Al Mulhim's (2014) findings about the perceived lack of support from the ministry and its impact on ICT implementation. These findings also conflict with the Ministry of Education's (2019) own claims about the importance of learning through technology, or at the very least demonstrate that government-level objectives had not reached local schools at the time data for this study was collected.

Lack of Incentives from the Ministry

All of the principals interviewed noted that there was also a lack of incentive from the Ministry to encourage ICT implementation. All of the principals interviewed mentioned this issue, directly stating or implying that it was an obstacle to implementing technology use within their schools. As Tarekstated:

There is absolutely no support or incentives from the Ministry, and this is considered one of the obstacles, because some teachers feel frustrated at the ministry's lack of interest in their efforts as well as the application of technology.

According to Tarek, a lack of support or incentives for technology was an obstacle to technology use as it appeared to frustrate teachers and dampen their enthusiasm for implementing technology. Osama echoed this sentiment when he said that "teachers need motivation and support encouragement to implement ICT in schools. Unfortunately, there is no motivation from the Ministry." As both Tarek and Osama noted, the apparent lack of encouragement at the government level was felt as a lack of motivation or incentive at the local

school level, resulting in frustration amongst teaching staff. If true, these findings would confirm those of Oyaid (2009), who pointed out that teachers need support and encouragement in order to feel motivated to integrate technology use into their instruction.

At the same time, it is possible that incentives from the Ministry of Education are not as essential to ICT implementation as the principals who participated in this study believed. In the interviews, the principals made a direct link between teacher motivation and incentives from the Ministry. Some teachers also mentioned that they did not receive incentives from the Ministry, but did not make a direct link between those incentives and their motivation to use technology. As mentioned previously, the teachers who participated in this study had an overall positive attitude toward ICT use, and believed in the benefits it offered in their work. That is, they appeared to be intrinsically motivated to use technology, and extrinsic motivation coming from the Ministry might not have been necessary.

Summary and Conclusion

Findings drawn from interviews with teachers and principals offered insights into the current status of ICT in Al-Ula schools and highlighted the challenges these schools were facing in their efforts to use ICT. In particular, thefindings from this study demonstrated that:

• While teachers appeared to have access to a range of ICT hardware and software, this hardware and software was inadequate for multiple reasons. The findings showed that much of the technology was obsolete, not functioning effectively (including slow internet access), and/or did not adequately meet the needs of students and staff. There were several possible causes noted for this condition: the technology itself was outdated or not working properly; schools were not given the necessary funding from the Ministry of Education; schools did not have on-site technical support staff; and there were not enough computers to allow for students to use them collaboratively.

• In general, teachers and principals appeared to have knowledge and training for basic computing tasks. However, implementing newer or more advanced technologies would likely require more training, as would implementation of more collaborative or interactive teaching methods.

• Although teachers and principals noted their dissatisfaction with the current status of technology use in their schools, most teachers also demonstrated a positive attitude toward technology use. Most teachers appeared to recognize the value and benefit of technology, and would likely be motivated toward changes in ICT implementation.

• The principals who participated in this study indicated a high level of encouragement and support for technology use. However, they did not appear to have a clear plan for technology implementation beyond being encouraging and supportive. One possible contributing factor to this lack of strategic planning was a lack of clear policy and direction from the Ministry of Education.

These findings suggest that improvement is needed in all of these areas within Al-Ula schools. As it stood at the time of the study, ICT Al-Ula schools appeared to be vastly under-resourced, and IT usage was not carefully planned at either the Ministry or the local school level. As such, the possibility of creating meaningful change in ICT implementation appeared to be unlikely at the time at the study. Some of the challenges presented by participants (e.g. slow internet, lack of technical support and maintenance) indicated that they had difficulty using ICT in relatively basic ways. Certainly, the schools were not in a good position to work with ICT in more advanced ways, including creating the kind of student-centered, interactive learning environment discussed by multiple scholars (Pall & Batra, 2016; Pelgrum, 2001; Edwyn; 2001) and the Ministry itself (*Education and Vision 2030,*2019). In order to implement

change at that level, Al-Ula schools would need a substantial increase in funding, resources, and training. And, they would need a more carefully planned and implemented change process.

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