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Mobile Learning Technologies as a Means of Maintaining Education Delivery In Crisis Situations

Hoda Baytiyeh, The American University of Beirut, Department of Education, Beirut, Lebanon

ABSTRACT

The disruption of education services during major crises poses a challenge for international agencies, governments, schools, and communities. The article demonstrates a potential role for mobile technologies in supporting continuity of education delivery during temporary school closures caused by such crises. Discussing how school administrators can reduce the impact on students, this article describes an interactive online educational environment and outlines the advantages of available mobile learning devices for this purpose. With proper training, teachers can integrate mobile learning tools in both classroom activities and out-of-classroom learning. The article will be of interest to educational policy makers and school administrators with responsibility for ensuring continued education delivery in the aftermath of major crises.

KEYWORDS

Educational Disruption, Emergency Education, Mobile Learning Technologies, School Closure

1. INTRODUCTION

Education disruption has been documented during major crises such as sectarian violence, natural disasters, and epidemics. In the first half of 2017, floods and typhoons forced 4.5 million people around the world to leave their homes, causing significant disruption of education processes; the 2017 South Asia floods alone destroyed or damaged 18,000 schools, affecting 1.8 million children (Save the Children, 2017). Armed conflicts can also paralyze education services where schools and teachers are attacked and students are displaced or relocated. Exacerbated by limited supplies and resources and challenging geographic contexts, the extensive damage triggered by such crises may result in long delays before education delivery can restart in temporary learning centers. Consequently, children lose long months of schooling, and many may lose interest in education, drop out of school, and fail to return to the learning environment (Anderson, 2006). The longer children are out of school, the less likely they are to return; for example, after Typhoon Washi in the Philippines in 2011, 23 percent of families said their children had permanently dropped out of school within one year (Save the Children, 2014). Education disruption also leaves children at risk of child labor, early marriage, exploitation, or recruitment into armed forces. During natural disasters, education often receives less funding than other sectors because it is not viewed as a lifesaving activity in the same way as shelter, food, and water. In recent years, however, various humanitarian organizations have advocated recognition of education as a life necessity.

Technology has greatly enhanced access to education, facilitating learning among many disadvantaged populations, including those affected by crises. The availability and accessibility of

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mobile devices means that a larger population of students can now be reached, and education delivery can be maintained online. We argue here that mobile learning technologies offer an alternative approach to the challenge of education delivery disruption, especially for children in regions affected by conflict or disaster.

2. MAINTAINING DELIVERY OF EDUCATION SERVICES DURING CRISES

Armed conflict and sectarian violence can severely disrupt delivery of formal education services, with long-term impacts on children's attainment and on enrollment and retention in schools (Justino, 2016; Valente, 2011). Children's educational attainment is particularly compromised by exposure to violence; according to Lai and Thyne (2007), armed conflicts reduce educational enrollment across all levels. In regions affected by violent conflict, the threat of kidnapping is a significant impediment to student enrollment and teacher retention and can lead to school dysfunction during active periods of fighting, with sporadic school closures. Additionally, schools may be damaged or temporarily be occupied by displaced people, or they may be used by military or other armed groups (Standing & Parker, 2011). As well as the impact on student safety and educational attainment, school closures and disruption of education delivery mechanisms impact severely on psychological development, including identity development. Students who are at risk of being injured or killed or who are forcefully displaced from their homes and communities and separated from their parents and families may suffer trauma or join militant groups.

It can also be challenging to maintain delivery of education services in the event of natural disasters such as earthquakes, hurricanes, or floods. The seismic vulnerability of school buildings and the absence or inadequacy of risk mitigation measures can have devastating consequences for schools, students, and educational delivery (Baytiyeh & Naja, 2013; Naja & Baytiyeh, 2014). School closures and disruption of education processes have traditionally been among the most severe consequences of natural disasters, particularly in flood-prone and seismically vulnerable regions, depriving millions of children of their fundamental right to education and threatening their future welfare, both physically and psychologically. Hurricanes Harvey and Irma, which hit the United States in 2017, provided clear evidence of the impacts of natural disasters in this regard, causing temporary school closures that prevented 1.7 million children from attending school for several weeks. Similarly, in Bangladesh in 2013, Tropical Storm Mahasen destroyed 171 schools and left more than 1,000 damaged, impacting more than 300,000 students (Save the Children, 2014). Following the floods in Pakistan in 2010, 1,800 schools had been damaged and many more were occupied by people fleeing the floods (Hartill, 2011). In the same year, Typhoon Haiyan damaged 3,000 schools in the Philippines, affecting about a million children (Save the Children, 2014).

The closure of schools during pandemics has also attracted increasing attention at the level of government policy; the severe threat of infectious disease means that school closure is often a necessary preemptive measure to mitigate the risk of contagion, as reported in relation to a number of major outbreaks (e.g., severe acute respiratory syndrome 2003; swine influenza 2009; Ebola 2013–2016; Zika 2015). During the Ebola outbreak, five million children in Africa were affected by school closures (Sifferlin, 2014); schools in Sierra Leone were closed for nine months and schools in Guinea and Liberia for six (Paye-Layleh & Dilorenzo, 2014). As a consequence of such extended closures, students tend to drop out of school and so attain a lower level of education.

3. FACING THE CHALLENGES

Given the high risks of maintaining traditional delivery of formal education during major crises, mobile learning technologies and applications offer a means of preventing interruption. The growing rate of Internet and mobile phone use has been documented across the globe. Worldwide, more than 3.5 billion people now use the Internet, representing a penetration rate of 51.7 percent (Internet

World Statistics, 2017); mobile phone penetration is also projected to continue growing, reaching five billion users (67 percent) by 2019 (Statista, 2017). Such advances have revolutionized access to information in educational settings, making it faster, easier, and cheaper for schools around the world to use computers, mobile phones, tablets, smart whiteboards, and other devices as part of the learning process.

The effectiveness of these tools has changed education fundamentally, with the traditional teacher-centered style giving way to a more active, student-centered approach, in which teachers serve as guides and facilitators rather than as disseminators of knowledge (Baytiyeh & Naja, 2010a). Mobile devices and technologies have also increased the scope for independent and creative learning, enhancing critical thinking by facilitating comparison of different sources and analyses (Baytiyeh, 2017; Baytiyeh & Naja, 2017). This increasing use of mobile devices has revolutionized the learning process both inside and outside the classroom. Internet, mobile phones, and social media applications have enhanced distance learning processes and enabled the creation of online learning communities (O'Bannon, Baytiyeh, & Beard, 2010).

Because they are portable, lightweight, and easy to use, these mobile learning technologies can be used to deliver education where it is most needed, especially in humanitarian emergencies such as war or natural disaster. By providing cost-effective, temporary education to the many children whose formal schooling is interrupted in such circumstances, technology-assisted learning helps to accelerate recovery, protecting children and enhancing their resilience to future adversity. For instance, the Varkey Foundation launched a distance-learning program in Ghana in 2014 that uses solar-powered computer technology in satellite-equipped schools to provide quality instruction for girls in rural and low-income areas. The success of that program led to the launch of a new distance-learning program that uses the same technology to train teachers across Ghana (Varkey-Foundation, 2015) and can be replicated in other complex situations.

The success of virtual learning in Africa establishes a baseline for interventions designed to reach a large number of displaced students affected by armed conflicts or natural disasters. Mobile learning technologies can also assist people with disabilities, those with full-time jobs, or people living in remote areas. One example of how mobile technology can help children with special needs is Proloquo2go, an assistive technology app available on iTunes. Students on the autism spectrum and others who may have difficulty speaking can use the app's library of symbols and text-to-speech conversion to communicate easily and naturally with others. Innovative mobile technologies have also contributed to gender equality in many parts of the world, providing women with access to lifelong learning, education, and training (ITU, 2003), particularly in societies where customs, traditions, or family obligations may affect women's willingness to seek education. As well as helping women to acquire knowledge, this access to education enhances their social profile and status. Mobile learning technologies also enable disadvantaged and marginalized rural communities to access and pursue education (UNESCO, 2015).

One of the most important positive features of mobile devices and applications is their potential to develop self-directed learners. This can be especially important in regions afflicted by conflict, where teachers may not be regularly available. Using electronic devices and the Internet, students can access new educational content and complete activities at their own pace. Although self-directed learning is particularly important for older students who typically take greater responsibility for their own learning, activity-based learning programs at primary level confirm that students of all ages can become self-directed learners (USAID, 2014). For example, apps such as Dictionary.com, Google Earth or Britannica facilitate rapid search of information sources; additionally, students can plot equations with Quick Graph, create their own stories with Story Kit, or navigate space using the NASA app (Wylie, 2017).

4. ADVANTAGES OF MOBILE LEARNING TECHNOLOGIES DURING CRISES

When used appropriately, mobile technologies, cloud computing, and social media tools have the potential to support children's safety and continuity of educational delivery during and after a crisis, when it may be impossible to maintain normal school operations. Over the last two decades, laptops, tablets, and mobile phones have proved capable of supporting formal learning in various educational settings, particularly during crises (Sung, Chang, & Liu, 2016). A review of the existing literature reveals that the flexibility, portability, and accessibility of mobile devices is generally welcomed by students (Fuegen, 2012). Features such as individualized interfaces, real-time access to information, context sensitivity, instant communication, and feedback can help to improve content knowledge, self-directed learning and inquiry learning (Lan, 2014; Lan, Sung, & Chang, 2007; Lan, Sung, Cheng, & Chang, 2015; Liu, Lin, & Paas, 2014; Wang & Wu, 2011).

Save the Children has called on the technology industry to find smartphone-based solutions for child learning during crises (Nield, 2016). Using mobile applications, students can download a wide variety of educational content, ranging from basic to complex. As most education-related mobile applications are designed to work offline, a simple smartphone can become the child's classroom when a school building is unusable following a natural disaster or lives are at risk because of violent conflict. For instance, during the Ebola outbreak in Sierra Leone and Liberia in 2014, schools were shut down for months, and children of all ages were confined to their homes. As infection rates continued to rise, education ministries and nongovernmental organizations explored the potential of mobile devices as an alternative means of delivering education.

In 2013, UNESCO acknowledged the need to modernize teaching by encouraging the use of mobile technologies in this context. The published guidelines recommended that government policies should encourage the use of mobile phones to enhance education and learning. Presented in Paris during Mobile Learning Week, UNESCO's flagship ICT event, the guide emphasized the need to train teachers in the use of mobile technologies.

5. EMERGENCY PLANNING FOR SCHOOL ADMINISTRATORS

A mobile device is often one of the few possessions taken by people forced to leave their towns or homes during conflicts or disasters. In these circumstances, mobile technology can bring learning to students and to disadvantaged populations more generally, regardless of location. For students, this means they can continue to interact and collaborate with their classmates and instructors. However, for this approach to work, preemptive planning is needed in order to prepare school administrators, teachers, and information technology (IT) staff for these challenges.

A primary requirement of any strategy to improve the resilience of schools and their capacity to sustain service delivery in times of crisis is communication maintenance, based on the creation of call trees. These trees, which help to ensure that groups and key personnel remain connected and are notified of any event or problem, can be automated by software programs, using cell phones and short message services (SMS). Previous studies have shown that instant messaging (IM) is useful in these circumstances, enabling students and teachers to ask questions after school hours and enhancing their sense of belonging to the community (Hrastinski, Edman, Andersson, Kawnine, & Soames, 2014; Scornavacca, Huff, & Marshall, 2009; Smit, 2012; Sweeny, 2010). Another convenient mobile tool for communication is WhatsApp, which was launched in 2009 and is available on many smartphone platforms. As of February 2016, this tool had been used by one billion people—nearly one in every seven people on the planet (WhatsApp, 2016). This cross-platform, mobile messaging application enables users to exchange messages, phone calls, images, videos, and audio clips on the same data plan they use for emails and web browsing. WhatsApp's immediacy, cost effectiveness, and unlimited messaging and its support for simultaneous conversations with many individuals (Church

& de-Oliveira, 2013) makes it a no-cost solution that allows teachers to create a WhatsApp group for each class (Baytiyeh, 2018).

Another important factor that administrators should consider in their emergency plan is the security of data servers. Cloud storage enables anyone with an Internet connection to access servers and services, as data are stored in third-party data centers that are usually some distance away from the user, across a city or across the world. Cloud technology enables access to shared computing resources, networks, servers, and applications, with minimal management effort. As part of Mobile Learning Week, a recent project trained Syrian refugee teachers to help traumatized students by using cloud technology to provide access to resources to help meet the complex needs of conflict-affected children. The project provides specialized training to about 150 teachers in ten pilot schools, as well as hardware and connectivity by means of a cloud-based local server. Using a notebook or tablet, teachers can access comprehensive teacher training materials, working at their own pace and sharing their experiences (UNESCO, 2016). Using such a platform, both teachers and children can learn online or offline and individually or collaboratively.

Cloud computing can also be used to host learning management systems in schools. Teachers and students who use the tools have ongoing access to the system, as do IT staff who provide necessary technical support and maintenance. If school authorities do not wish to pay to host their learning management systems in the cloud, other platforms are available. MoodleCloud, which was launched in July 2016, is a cloud-hosted solution for educators that attracts no installation or hosting charges. Providing all the advantages of the most recent version of Moodle, this platform is ideal for individual classes, with unlimited courses and video conferencing for up to six users. Administrators can enroll users, manage multiple courses, and add content without having to install, maintain, or upgrade the software or servers. Edmodo is another free online tool that allows teachers and students to share files and resources, with real-time communication and unlimited storage, allowing teachers to create groups, assign homework, schedule quizzes, post homework information, and write short summaries of lessons for students who are absent (Balasubramanian, Jaykumar, & Fukey, 2014; Holland & Muilenburg, 2011). Google Drive is a further free solution for educational institutions that requires no downloads or software or hardware purchases. Teachers can create their own Google sites to share files and content with their students for synchronous and asynchronous collaboration. Google Apps for Education (GAFE) is a suite of free applications for educational institutions (Gmail, Calendar, Drive, Docs, Sites, etc.) that can be used to deliver education services during an emergency. Once registered, the school is assigned a domain, with accounts for all teachers and students, enabling them to collaborate and save their work in the cloud.

By exploiting the available mobile technologies and cloud computing tools for technology-assisted learning, school administrators can plan, design, and implement a preemptive strategy that prepares teachers and students to switch to an online teaching-learning environment in the event of an emergency. However, a lack of familiarity with these tools and insufficient teacher preparation are major obstacles to exploiting their documented advantages during school closures (Frohberg, Goth, & Schwabe, 2009; Penuel, 2006). For that reason, online or cloud-based workshops should be organized to enable teachers to create an online version of their courses, using whichever tools are chosen by the school's administrators. For example, if a set of social media tools is selected for lesson delivery, teachers must be able to decide which tool best fits their courses. They can then upload learning materials to the chosen online platform (probably at least weekly) while the traditional educational process is ongoing. In the event of a crisis involving school closure, teachers can then inform students that an online version of their course is available, along with the learning materials covered in the classroom. Prior to use, each teacher should also organize a session for their students to demonstrate how the online tool works.

Workshops should also be organized for parents to inform them about the strategy to be implemented in case of temporary school closure, as they play a critical role in effective student learning in such circumstances. Parental involvement has been shown to help in building a positive attitude to education and in behavioral outcomes (Baytiyeh & Naja, 2010b), so reducing dropout rates (Barnard, 2004). As teachers are physically absent during online learning, parents must assist in keeping learners focused on their assigned tasks (Russell, 2004) and providing the necessary encouragement and accountability to ensure that their child achieves the stated learning goals. Beyond their contribution to student academic performance, parents are also known to be the key source of social support for children during disasters (Prinstein, Greca, Vernberg, & Silverman, 1996), providing a sense of physical safety as well as emotional support, comfort, and nurturing.

School administrators need to inform parents and students about the availability of this alternative teaching and learning framework. For piloting purposes, the school can be closed for a specified number of days to test the process. This phase is crucial in ensuring that teachers, students, parents, and IT staff have adequate knowledge of the strategy and how it functions in case of a real crisis and provides administrators, IT staff, and teachers with feedback about any procedural gaps that may need to be bridged.

When a crisis prevents students from attending school, administrators can use this alternative solution to maintain the continuity of the teaching and learning process. Administrators can contact students, parents, teachers, and staff by phone, WhatsApp, or email to inform them of the emergency situation and to initiate use of the selected online teaching and learning tools during this period. Teachers can contact students by email or WhatsApp to remind them of the procedures for using these online tools, updating them as needed and creating discussion forums for questions, answers, and class interaction. Teachers, administrators, and staff can communicate regularly, sharing information, inquiries, and support. Parents can check the online resources for updates, as well as monitoring their children's learning tasks and following up with teachers to ensure their children are on the right track. The teaching and learning process can be conducted online until the school reopens.

This suggested solution is intended only for short-term, temporary delivery of learning materials; once schools reopen, teachers should administer tests to evaluate students' comprehension of the lessons provided online. The results of this evaluation will guide teachers in covering the remaining curriculum topics and to revisit the material learned online using a traditional face-to-face teaching approach if gaps need to be addressed.

Migrating from traditional educational processes to a virtual environment at times of crisis is a challenging task that requires teachers to establish appropriate interaction with their students. Teachers must translate the characteristics that make them successful in the classroom to online teaching, which requires the necessary dedication to guide students through online learning materials and to respond to their questions while maintaining live interactions among students. Teachers are also known to play a key role in helping students to cope and to express their emotions during disasters (Johnston & Redlener, 2006; Peek & Fothergill, 2006).

For effective emergency planning, school administrators and staff must ensure the functionality of the designed information and the communications infrastructure. A reliable power source and internet connection are essential for effective plan implementation. As crises can have severe physical and effects on students' psychological and social development of students as well as detrimental educational impacts (Delaney-Black et al., 2002), teaching and learning should occur in a safe and conducive environment assisted by available ICT. For example, access to social media platforms can encourage students to communicate with friends and teachers and to release some of their stress with the help of peer mental health support and more active self-management of problems (Aggarwal, 2012).

6. CONCLUSION

This article outlines how proactive measures based on mobile learning technologies can help to maintain teaching and learning processes during temporary school closures triggered by sudden crises. Such events and their aftermath can severely disrupt delivery of education services, with long-term consequences for student enrollment and retention in school, as well as for their cognitive, academic, and socioemotional development. In such circumstances, mobile learning technologies offer an alternative means of providing access to learning materials in both formal and non-formal settings. The spread of inexpensive mobile technology devices and applications offers such opportunities to millions of displaced and disadvantaged children in regions affected by natural disasters and armed conflicts. While recent research highlights the increasing use of these tools to address the educational challenges confronting displaced children in times of crisis, this issue remains largely underexplored.

The article outlines a strategy that enables school administrators in vulnerable regions to improve the resilience of education delivery processes by using mobile technologies. It is argued that, with adequate support from the administration and IT staff, teachers can be better prepared to use mobile learning technology tools in such circumstances. Educational leaders and administrators in vulnerable regions are urged to exploit the benefits of these tools and applications and to develop training programs to improve teachers' skills and motivation to use mobile learning technologies to reach and teach students in times of crisis.

REFERENCES

Aggarwal, N. K. (2012). Applying mobile technologies to mental health service delivery in South Asia. *Asian Journal of Psychiatry*, *5*(1), 225–230. doi:10.1016/j.ajp.2011.12.009 PMID:22981050

Anderson, A. (2006). Standards Put to the Test: Implementing the INEE Minimum Standards for Education in Emergencies Chronic Crisis and Early Reconstruction. *AWS*. Retrieved from http://s3.amazonaws.com/inee-assets/resources/doc_1_83_networkpaper057.pdf

Balasubramanian, K., Jaykumar, V., & Fukey, L. N. (2014). A study on Student preference towards the use of Edmodo as a learning platform to create responsible learning environment. *Procedia: Social and Behavioral Sciences*, *144*(1), 416–422. doi:10.1016/j.sbspro.2014.07.311

Barnard, W. M. (2004). Parent involvement in elementary school and educational attainment. *Children and Youth Services Review*, *26*(1), 39–62. doi:10.1016/j.childyouth.2003.11.002

Baytiyeh, H. (2017). The flipped classroom model: When technology enhances professional skills. *The International Journal of Information and Learning Technology*, *34*(1), 51–62. doi:10.1108/IJILT-07-2016-0025

Baytiyeh, H. (2018). Students' Use of Mobile Technologies: Motivational Factors. *International Journal of Information and Communication Technology Education*, *14*(1), 73–85. doi:10.4018/IJICTE.2018010106

Baytiyeh, H., & Naja, M. K. (2010a). Do multimedia features promote understanding and retention. *International Journal of Instructional Media*, *37*(1), 43–54.

Baytiyeh, H., & Naja, M. K. (2010b). Students' enrollment in engineering: Motivational factors. *International Journal of Engineering Education*, *26*(5), 1192–1199.

Baytiyeh, H., & Naja, M. K. (2013). Promoting Earthquake Disaster Mitigation in Lebanon through Civic Engagement. *Disaster Prevention and Management*, *22*(4), 340–350. doi:10.1108/DPM-05-2013-0080

Baytiyeh, H., & Naja, M. K. (2017). Students' perceptions of the flipped classroom model in an engineering course: A case study. *European Journal of Engineering Education*, *42*(6), 1048–1061. doi:10.1080/03043797.2016.1252905

Church, K., & de-Oliveira, R. (2013). What's up with WhatsApp? Comparing Mobile Instant Messaging Behaviors with Traditional SMS. *Paper presented at the Mobile HCI-Collaboration and Communication*, August 30, Munich, Germany.

Delaney-Black, V., Covington, C., Ondersma, S. J., Nordstrom-Klee, B., Templin, T., Ager, J., & Sokol, R. J. (2002). Violence exposure, trauma, and IQ and/or reading deficits among urban children. *Archives of Pediatrics & Adolescent Medicine*, *156*(3), 280–285. doi:10.1001/archpedi.156.3.280 PMID:11876674

Frohberg, D., Goth, C., & Schwabe, G. (2009). Mobile learning projects – a critical analysis of the state of the art. *Journal of Computer Assisted Learning*, *25*(1), 307–331. doi:10.1111/j.1365-2729.2009.00315.x

Fuegen, S. (2012). The Impact of Mobile Technologies on Distance Education. *TechTrends*, *56*(6), 49–53. doi:10.1007/s11528-012-0614-0

Hartill, L. (2011). Save the Children Launches Emergency Response to Devastating Pakistan Floods. *Save the Children*. Retrieved from http://www.savethechildren.org/site/apps/nlnet/content2.aspx?c=8rKLIXMGIpI4E&b=6478615&ct=11213203

Holland, C., & Muilenburg, L. (2011). Supporting student collaboration: Edmodo in the classroom. *Paper presented at the Society for Information Technology & Teacher Education International Conference*, Austin, TX.

Hrastinski, S., Edman, A., Andersson, F., Kawnine, T., & Soames, C. A. (2014). Informal math coaching by instant messaging: Two case studies of how university students coach K-12 students. *Interactive Learning Environments*, *22*(1), 84–96. doi:10.1080/10494820.2011.641682

Internet World Statistics. (2017). World Internet Users and 2017 Population Stats. Retrieved from http://www.internetworldstats.com/stats.htm

ITU. (2003). World telecommunication development report: Access indicators for the information society. Retrieved from http://www.itu.int/net/wsis/tunis/newsroom/stats/WorldTelecomDevelopmentReport-2003_E.pdf

Johnston, C., & Redlener, I. (2006). Critical Concepts for Children in Disasters Identified by Hands-On Professionals: Summary of Issues Demanding Solutions before the Next One. *Pediatrics*, *117*(5 Suppl. 4), 458–460. doi:10.1542/peds.2006-0099W PMID:16735284

Justino, P. (2016). Supply and demand restrictions to education in conflict-affected countries: New research and future agendas. *International Journal of Educational Development*, *47*(1), 76–85. doi:10.1016/j.ijedudev.2016.01.002

Lai, B., & Thyne, C. (2007). The Effect of Civil War on Education, 1980—97. *Journal of Peace Research*, *44*(3), 277–292. doi:10.1177/0022343307076631

Lan, Y. J. (2014). Does second life improve mandarin learning by overseas Chinese students? *Language Learning & Technology*, *18*(1), 36–56.

Lan, Y. J., Sung, Y. T., & Chang, K. E. (2007). A mobile-device-supported peer-assisted learning system for collaborative early EFL reading. *Language Learning & Technology*, *11*(1), 130–151.

Lan, Y. J., Sung, Y. T., Cheng, C. C., & Chang, K. E. (2015). Computer-supported cooperative prewriting for enhancing young EFL learners' writing performance. *Language Learning & Technology*, *19*(1), 134–155.

Liu, T. C., Lin, Y. C., & Paas, F. (2014). Effects of prior knowledge on learning from different compositions of representations in a mobile learning environment. *Computers & Education*, *72*(1), 328–338. doi:10.1016/j.compedu.2013.10.019

Naja, M., & Baytiyeh, H. (2014). Towards safer public school buildings in Lebanon: An advocacy for seismic retrofitting initiative. *International Journal of Disaster Risk Reduction*, *8*(1), 158–165. doi:10.1016/j.ijdrr.2014.03.005

Nield, D. (2016). Smartphone schools could help Syria's child refugees. *The Guardian*. Retrieved from https://www.theguardian.com/sustainable-business/2016/apr/22/smartphone-schools-help-syrias-child-refugees-aliim-apps

O'Bannon, B., Baytiyeh, H., & Beard, J. (2010). Using wikis to create collections of curriculum-based resources: Perceptions of pre-service teachers. *Paper presented at the Society for Information Technology & Teacher Education International Conference*, Nashville, TN. Association for the Advancement of Computing in Education (AACE).

Paye-Layleh, J., & Dilorenzo, S. (2014). Fear of Ebola keeps patients from seeking treatment for other diseases in African clinics. *The Chronicle Herald*. Retrieved from http://thechronicleherald.ca/world/1248683-fear-of-ebola-keeps-patients-from-seeking-treatment-for-other-diseases-in-african-clin

Peek, L., & Fothergill, A. (2006). *Reconstructing Childhood: An Exploratory Study of Children in Hurricane Katrina, Quick Response Report #186*. Boulder, CO: Natural Hazards Research and Applications Information Center, University of Colorado.

Penuel, W. R. (2006). Implementation and effects of 1:1 computing initiatives: a research synthesis. *Journal of Research on Technology in Education*, *38*(1), 329–348. doi:10.1080/15391523.2006.10782463

Prinstein, M. J., Greca, A. M. L., Vernberg, E. M., & Silverman, W. K. (1996). Children's Coping Assistance: How Parents, Teachers, and Friends Help Children Cope after a Natural Disaster. *Journal of Clinical Child Psychology*, *25*(4), 463–475. doi:10.1207/s15374424jccp2504_11

Protecting Education. (2014). No Child Left Behind: Education in crisis in the Asia–Pacific region. Retrieved from http://www.protectingeducation.org/sites/default/files/documents/save_the_children_australia_-_no_child_left_behind.pdf

Russell, G. (2004). Virtual schools: A critical view. In C. Cavanaugh (Ed.), *Development and management of virtual schools: Issues and trends*. Hershey, PA: IGI Global. doi:10.4018/978-1-59140-154-4.ch001

Save the Children. (2017). 1.8 million children out of school as South Asia floods put education at risk. Retrieved from http://www.savethechildren.org.uk/2017-08/18-million-children-out-school-south-asia-floods-put-education-risk

Scornavacca, E., Huff, S., & Marshall, S. (2009). Mobile phones in the classroom: If you can't beat them, join them. *Communications of the ACM*, *52*(4), 142–146. doi:10.1145/1498765.1498803

Sifferlin, A. (2014). 5 Million Kids Aren't in School Because of Ebola. *Time*. Retrieved from http://time.com/3637570/5-million-kids-arent-in-school-because-of-ebola/

Smit, I. (2012). WhatsApp with BlackBerry; Can Messengers (BBM) be MXit? *Paper presented at the 14th Annual Conference on World Wide Web Applications*, South Africa, Cape Town, Cape Peninsula University of Technology.

Standing, K., & Parker, S. (2011). The effect of the 'People's War' on schooling in Nepal, 1996–2006. *Education, Citizenship and Social Justice*, *6*(2), 181–195. doi:10.1177/1746197911410376

Statista. (2017). Number of mobile phone users worldwide from 2013 to 2019. Retrieved from https://www.statista.com/statistics/274774/forecast-of-mobile-phone-users-worldwide/

Sweeny, S. M. (2010). Writing for the instant messaging and text messaging generation: Using new literacies to support writing instruction. *Journal of Adolescent & Adult Literacy*, *54*(2), 121–130. doi:10.1598/JAAL.54.2.4

UNESCO. (2015). Mobile Phones & Literacy: Empowerment in Women's Hands – A Cross-Analysis of Nine Mobile Experiences. Retrieved from http://unesdoc.unesco.org/images/0023/002343/234325E.pdf

UNESCO. (2016). Syrian teachers use cloud technology to create safe schools for refugee students. Retrieved from http://en.unesco.org/news/syrian-teachers-use-cloud-technology-create-safe-schools-refugee-students

USAID. (2014). Using technology to deliver educational services to children and youth in environments affected by crisis and/or conflict. Retrieved from https://www.usaid.gov/what-we-do/education/educating-children-and-youth-crisis-and-conflict-situations/Using-Technology-Deliver-Educational-Services

Valente, C. (2011). *Children of the Revolution: Fetal and Child Health amidst Violent Civil Conflict*. Sheffield, UK: Department of Economics, University of Sheffield.

Varkey-Foundation. (2015). British Minister Praises MGCubed Distance Learning Project in Ghana. Retrieved from https://www.varkeyfoundation.org/blog/british-minister-praises-mgcubed-distance-learning-project-ghana

Wang, S. L., & Wu, C. Y. (2011). Application of context-aware and personalized recommendation to implement an adaptive ubiquitous learning system. *Expert Systems with Applications*, *38*(1), 10831–10838. doi:10.1016/j.eswa.2011.02.083

WhatsApp. (2016). About WhatsApp. Retrieved from https://www.whatsapp.com/

Wylie, J. (2017). Mobile Learning Technologies for 21st Century Classrooms. Retrieved from http://www.scholastic.com/browse/article.jsp?id=3754742

Hoda Baytiyeh received a PhD in education from the University of Tennessee–Knoxville, USA. She is an associate professor in the Department of Education at the American University of Beirut. Her primary research areas of interest include online learning communities, education in emergencies, impacts of ICTs on disasters and peace-building in conflict-affected societies.