



Implementing a Digital Learning Initiative: a Case Study in K-12 Classrooms

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Abstract

Mobile devices have become especially enticing to schools because of their portability, flexibility, and intuitive interfaces. A growing number of schools have begun using tablets as a cost-effective strategy in a digital learning environment. Other schools have embraced a bring your own device (BYOD) policy, which addresses pedagogical goals as well as the lack of funds many schools struggle with to support digital learning. BYOD makes digital learning easier by leveraging the devices students already have. The purpose of this study was to explore a digital learning initiative implementation in a large public school district in southwest Florida in order to provide formative feedback to guide its digital learning initiative beyond the initial implementation.

Keywords Digital learning · BYOD · K-12 · Technology · Mobile · Teaching

Introduction

The interest in digital learning in K-12 education has begun to shift teacher and administrator attitudes towards the capabilities of technology tools in the classroom. There is an abundance of resources and relationships that are easily accessible in a digital learning environment, and this has challenged K-12 education to adapt. Mentoring and preparing students for the world in which they will live and work is a primary consideration for educational institutions. This has placed pressure on teachers to incorporate emerging technologies and new media into their classrooms and curriculum.

In order to shift from the traditional instructional materials to digital and more innovative resources, teachers should be offered opportunities to prepare for the transformational curriculum. To be ready for this shift, teachers should be provided professional development to practice all of the competencies that will help them adopt this change successfully. These competencies include skills and knowledge in the use of digital tools in all curriculum domains and making students learning extend beyond the classroom (Bonanno 2011).

Technology has great potential to enhance curriculum and teaching processes. However, teachers may not be ready to

integrate technology and not have adequate knowledge and skills to utilize technology to support the curriculum. Researchers and the educational agencies in the last decade have focused on preparing teachers to integrate digital technology in instruction. The National Council for Accreditation of Teacher Education (NCATE) emphasized that teachers must take advantage of technology for instruction and be prepared to use technology effectively in the classroom (Afshari et al. 2013). In order to be ready to integrate technology in the curriculum, teachers must be provided with a solid foundation of knowledge and skills in digital media and develop new understandings, new approaches, new roles, new forms of professional development, and new attitudes about technology integration (Ruggiero and Mong 2015; Sabzian and Gilakjani 2013). Professional development opportunities will help teachers make a paradigm shift in their conception of curriculum and move from printed traditional curriculum to digital curriculum. The successful implementation of digital technology into the curriculum relies heavily on teachers' readiness and willingness to adopt technology (Singh and Chan 2014; Summak et al. 2010). Teachers can integrate digital technology to supplement and support the curriculum, facilitate teachers' work, and encourage student-centered learning (Ertmer et al. 2012). To meet the new demands, teachers need professional development opportunities beyond core subjects. They need opportunities to acquire all the technical and pedagogical skills that enable them to integrate digital technology effectively and efficiently into the school curriculum.

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Digital learning is any instructional practice that effectively uses technology to strengthen a student's learning experience. It emphasizes high-quality instruction and provides access to challenging content, feedback through formative assessment, opportunities for learning anytime and anywhere, collaboration with others, and individualized instruction to ensure all students reach their full potential to succeed in college and a career. Digital learning encompasses many different facets, tools, and applications to support and empower teachers and students, such as digital content and resources, mobile devices, bring your own device (BYOD), gamification, and 3D printing. Additionally, digital learning can be used for professional learning opportunities for teachers and to provide personalized learning experiences for students.

Some of the most common themes related to the digital learning environment over the past several years include collaborative learning, personalized learning, and mobile learning (Johnson et al. 2013; Johnson et al. 2014; Johnson et al. 2015; Adams Becker et al. 2016). Collaborative learning refers to students and/or teachers working together in peer-to-peer or group activities. It is based on the perspective that learning is a social construct. Collaborative learning models are proving successful in improving student engagement and achievement, especially for disadvantaged students. Teachers also benefit through peer groups as they engage in professional development and interdisciplinary teaching opportunities (Johnson et al. 2015). Personalized learning refers to the range of educational programs, learning experiences, instructional approaches, and academic support strategies intended to address the specific learning needs, interests, aspirations, or cultural backgrounds of individual students (Abel 2016). The increasing focus on customizing instruction to meet students' unique needs is driving the development of new technologies that provide more learner choice and allow for differentiated content delivery. Technology alone is not the whole solution; personalized learning efforts must incorporate effective pedagogy and include teachers in the development process (Adams Becker et al. 2016). Mobile devices have become especially enticing to schools because of their portability, flexibility, and intuitive interfaces. A growing number of schools have begun using tablets as a cost-effective strategy in a digital learning environment. Other schools have embraced a BYOD policy, which addresses pedagogical goals as well as the lack of funds many schools struggle with to support digital learning. BYOD makes digital learning easier by leveraging the devices students already have. Shuler (2009) remarked that mobile devices might be used to capitalize on the personalization capabilities of the devices that make learning more accessible. Mobile devices can bridge learning in school, afterschool, and home environments.

The interest in digital learning in K-12 education has begun to shift teacher and administrator attitudes towards the capabilities of technology tools in the classroom. However, it is well known that the successful implementation requires heavily on teachers' readiness and willingness to adopt technology. What is new is the

ready availability of a wide variety of digital technologies to provide opportunities for collaborative, student-centered learning and teacher professional development. As digital learning becomes more ubiquitous in classrooms, it is important to discover its impact on teachers, who must make a paradigm shift in their conception of curriculum and instructional strategies, from traditional to digital.

Purpose of the Study

The purpose of this study was to explore a digital learning initiative implementation in a public school district in southwest Florida in order to provide formative feedback to guide its digital learning initiative beyond the initial three-year implementation. The study will describe the implementation in years two and three.

The district originally implemented a BYOD program in its secondary schools. The BYOD program was developed with full district leadership support, including financial and staff resources. In an effort to combat technology inequity among students, the district simultaneously implemented a community outreach program to collect newer, used devices that could be made available to students in need. At the same time, the district hosted several community workshops on digital citizenship and responsible technology use. These workshops included panels made up of district staff, technology experts, business leaders, and local law enforcement. While BYOD has profound implications for K-12 education because it creates the conditions for student-centered learning to take place, the district realized that effectively using technology is not limited to student-owned devices. Thus, the implementation then evolved into a broader digital learning initiative. The district now seeks formative feedback as they continue to expand the digital learning initiative in the elementary grades, and to expand the collaborative, student-centered learning opportunities that digital learning provides.

Research Questions

The following research questions guided the investigation:

1. How do teachers and school administrators perceive the digital learning implementation?
2. What are teachers' opinions of the digital learning initiative?
3. What lessons from the digital learning implementation can help improve or expand the program and/or inform the design of other digital learning initiatives in the future?

Methodology

The researcher's university and the public school district have an established memorandum of understanding for research collaboration on implementing a digital learning initiative. The research collaboration partnership was created to assess the efficacy of the school district's digital learning initiative. The goal of this research collaboration is to identify effective and practical ways of implementing digital learning that will enhance student-learning experiences and ultimately improve student learning. This was the first of several formative studies that will be conducted as part of the memorandum of understanding. The study was conducted over a one-year period and was limited to nine schools in the district that were in years two or three of the digital learning initiative, rather than to all 48 schools in the district or to other local public school districts. This bounding of the study is consistent with a qualitative evaluation case study design (Yin 1984). In the constructivist tradition, this study incorporated the paradigm assumptions of a context-dependent inquiry and an inductive data analysis (Guba and Lincoln 1988). The core concept of constructivism is in our interactions with the environment. What we understand is a function of the content, the context, and the activity of the learner. An implication of this proposition is that cognition is not just within the individual but rather it is a part of the entire context, i.e., cognition is distributed (Honebein et al. 1993).

The theoretical framework for the methodology of the study is grounded in case study theory (Creswell 2003). Formative research follows a case study approach as outlined by Yin (1984). Yin believes that a single case study is appropriate when "a how or why question [has been] asked about a contemporary set of events" (p. 20). This type of methodology lends itself well to researcher/teacher collaboration. Case study research can be used to provide formative feedback and is particularly suited for applied fields of study such as education (Merriam 1998). "Educational processes, problems, and programs can be examined to bring about understanding that in turn can affect and perhaps even improve practice" (Merriam 1998, p. 32). This is the nature of formative research. Merriam further states that case study research is particularly useful for studying educational innovations or evaluating programs. Case study is appropriate when the objective of an evaluation is to develop a better understanding, offer feedback for improvement, and provide a common language that allows the results of a study to be communicated more easily to non-researchers (Merriam 1998). The definition from Creswell et al. (2007) seems to best capture the full depth and breadth of case study concepts and descriptions. The authors describe case study as "a methodology, a type of design in qualitative research, an object of study and a product of the inquiry" (p.245).

Participants

The participants in this study were K-12 teachers and school-based administrators who were part of the district's digital learning initiative implementation. All of the schools were in year two or three of the implementation. The participants were selected using criterion sampling (Miles and Huberman 1994), where the primary criterion was teachers or administrators who were in year two or three of the digital learning initiative implementation. We employed a maximum variation strategy (Miles and Huberman 1994) in order to have diversity of gender, geographic region within the 2300 square mile school district, subject areas, grade levels, and primary uses of devices (teachers only or teachers and students). Using the identification methods described, we sought out teachers and contexts that were varied within the boundary of the study.

Twenty-six teachers and eight administrators agreed to participate. The characteristics of each of the participants for this study are presented in Table 1 and they are summarized as follows: (a) 27 were female; (b) ages ranged from mid-20s to 60s; (c) grades ranged from K through 12, with nine in elementary grades and 17 in secondary grades; (d) subject areas included elementary, English language arts, English as a second language, geometry, math, physical science and health, science, social studies, and technology; and (e) number of years teaching ranged from one to 31.

Research Methods

The use of multiple methods to collect and analyze data are encouraged and found to be mutually informative in case study research where together they provide a more synergistic and comprehensive view of the issue being studied (Merriam 2009; Yin 2014). Qualitative research methods used in this study included the following: semi-structured interviews, observations, and systematic and concurrent data collection and data analysis procedures. Throughout the data collection phase, interview and observation data were analyzed, coded, themes developed, and themes interpreted for meaning. Creswell (2003) emphasized with qualitative research, many components of data collection, analysis, and reporting are simultaneous activities and researchers must cycle back and forth between these phases.

This study used observations that were conducted before the semi-structured interviews. Observations in each of the 26 teacher classrooms were conducted throughout the study. Each observation lasted at least three class periods, or two hours. Observations allow for deep understanding of the context and phenomenon occurring in the natural settings of the participants. Patton (2002) advised that the world is viewed through open-minded observation. Glesne (2006) suggested that observations should occur before the interview in order to develop understandings of the settings and the

Table 1 Overview of participants

Name	Age range	Gender	Years teaching	Grade(s)	Subject area(s)	Graduate of teacher education program?
1. Jackie	20s	Female	1	9–12	Geometry	No
2. Kate	30s	Female	3	9–12	Science	No
3. Amy	50s	Female	31	9–12	Developmental language	Yes
4. Sandra	30s	Female	4	7	Language arts	No
5. Emma	20s	Female	3	8	Physical science and health	No
6. Kaylee	20s	Female	6	6	Science for English language learners	Yes
7. Brenda	20s	Female	5	K	All subjects	Yes
8. Selma	30s	Female	5	4	All subjects	Yes
9. Arianna	40s	Female	2	3	All subjects	No
10. Joy	20s	Female	3	2	All subjects	No
11. Laura	20s	Female	4	4	All subjects	Yes
12. Grace	30s	Female	5	4	All subjects	No
13. Jordan	30s	Female	7	8	Science	Yes
14. Paula	40s	Female	15	7	English language arts	Yes
15. Victor	20s	Male	6	8	English language arts	Yes
16. Kathy	50s	Female	20	6	Science	No
17. Lisa	40s	Female	20	7	Science	Yes
18. Jenn	20s	Female	5	4	All subjects	Yes
19. Kara	20s	Female	4	4	All subjects	Yes
20. Vera	20s	Female	5	3	All subjects	Yes
21. Ben	30s	Male	8	6–8	Technology	No
22. Louise	60s	Female	30	7	Social studies	Yes
23. Mary	40s	Female	2	6	English language arts	No
24. Barb	20s	Female	2	9–12	English language arts	No
25. Nick	20s	Male	4	9–12	Science	Yes
26. Tess	40s	Female	21	9–12	Math to English language learners	Yes

participants. According to Merriam (1998), observation is a primary data collection method in qualitative research and when combined with interviewing as part of comprehensive fieldwork study, allows for a holistic interpretation of the phenomenon being investigated (p. 111). Classroom observations allowed for exploration into the interactions among the teachers, students, and technology. The researcher acted as an observer as participant during the observations (Merriam 1998). The researcher's field notes contained a verbal description of the setting, the people, and the activities, direct quotations, and observer's comments. The researcher used a checklist for the field notes that included the following: the setting, the participants, activities and interactions, frequency and duration of the situation, noted unplanned or informal activities, and what did not happen (Merriam 1998).

This study also used semi-structured interviews conducted in the teacher's classroom or administrator's office, which was a mutually agreed upon location between the researcher and the participant. Twenty-six teachers were interviewed. Interviews were conducted one-on-one for a minimum of one hour. Interview protocols

were developed to understand the participants' behaviors, feelings, opinions, and knowledge. The interview consisted of ten open-ended questions that allowed participants to engage in conversation about their experiences in the digital learning implementation, both in the classroom and with professional development. Participants were also given time to elaborate and expand on their perceptions of the digital learning initiative. Interviews were digitally recorded and transcribed with the consent and approval of each participant. Participants were given an opportunity to review the transcribed notes from their interviews and provide any necessary clarifications. Further, the researcher assured each participant that any identifying information would not be included in the final report of findings. Pseudonyms are used in participant descriptions. Using a similar protocol, eight building administrators from nine schools were interviewed.

In order to gain meaning from the data, interview transcripts and field notes were collected, categorized, synthesized, analyzed for patterns, and interpreted (Bogdan and Biklen 2003; Glesne 2006). Data analysis began simultaneously with data collection to allow for the continued

refinement of the study as it proceeded. Coding was used to organize, classify, find patterns, and make connections in the data (Glesne 2006). The researcher was solely responsible for coding, analyzing, and interpreting the data, since codes and categories were not preset and were generated continuously (Glaser 1978). The first level of coding, open coding, broke the data into small pieces (Glesne 2006) to develop a rudimentary coding scheme. Categories began to emerge that continually became more complex with further collection and analysis. Data were assembled into like-minded clumps in order to begin a rudimentary analysis. Use of coding memos enabled initial development of coding schemes and laid the groundwork for the developing story. Each entry in the electronic codebook had its own number and page, and subcodes were further numbered. Initial explanations of codes aided in continual refinement of the data. Coding memos were also located in the codebook, so that all data pieces were kept in a single location. The second level of coding consisted of analytic coding and focused on classifying and categorizing the units of meaning (Glesne 2006). Each of the initial codes was further analyzed for subcodes that may have emerged and each piece of data received a code name and number to assist in the analysis process. Interview protocols were listed with the participant's first initial, followed by the letters IP to indicate interview protocol, followed then by the number of the interview. Similarly, observations were also coded using initials and dates. As codes and subcodes were further developed and refined, data were continually added until the point of saturation, where further examination of data yielded redundant information (Glaser and Strauss 1967). All of the above analysis was kept in the codebook to allow for continual reflection and refinement. The process outlined above follows the constant comparative method, which consists of four distinct stages (Glaser and Strauss 1967). The first is comparison of incidents applicable to each category; this occurred in the first level of coding as described above. The second stage is integration of categories and their properties, outlined above as analytic coding. The third stage, delimiting the theory, refers to the saturation of codes and establishment of higher-level concepts that have emerged from the data. The final stage is writing the themes, but this could occur only after the data had been transformed into interpretation (Glesne 2006). Interpretation occurs when the researcher "transcends factual data and cautious analysis and begins to probe into what is to be made of them" (Wolcott 1994, p. 36). Data interpretation led to an understanding of how teachers and school administrators perceive the digital learning implementation, the opinions of the teachers about the digital learning initiative, and what lessons might be learned from the digital learning initiative that may help improve or expand the program and/or inform the design of other digital learning initiatives in the future.

Validity, or trustworthiness, is an important consideration in this qualitative study. The researcher has been invested in digital learning for a significant period of time and is dedicated to helping teachers gain knowledge and skills in the use of digital tools for learning. Lincoln and Guba (1985) argue that ensuring credibility is one of the most important factors in establishing trustworthiness. The researcher employed the following procedures to ensure credibility: prolonged engagement and persistent observation, triangulation of data, peer review, and clarification of researcher bias (Creswell 2003; Merriam 2009). The researcher was involved in the study for a prolonged period of time and spent a significant amount of time in the field. The researcher was able to develop trust, learn the culture of the experience and continually verify researcher suppositions. Credibility was also ensured by the researcher's use of multiple data collection methods and multiple sources: interviews at different junctures and observations throughout the experience. Peer review to review the researcher's initial "hunches" and codes also increased validity and credibility (Merriam 2009). Lastly, researcher bias is inherent in the design. Instead of attempting to control these biases, their presence throughout the study is acknowledged. As Peshkin (1988) notes, "objectivity is impossible because one's subjectivity is like a garment that cannot be removed." (p. 17). In light of the above, it is important to acknowledge some assumptions that were a part of designing this study; (1) Teachers are a rich and worthy source of knowledge about teaching and their own practice; (2) Teachers are not executors of curriculum; they have their own pre-existing beliefs and values that guide and shape their teaching, (3) Professional learning can make an impact on teachers' practices and beliefs. In order to understand the impact of digital learning, it is important that we enhance our understanding of their understandings as they engage in teaching and transfer it to their own contexts.

Findings

Findings are organized into two sections. With data from 26 purposively selected teachers and eight building administrators in nine schools, participant descriptions were developed and five themes emerged. Pseudonyms are used for all participants and their schools. Quotations are verbatim comments and they are uncorrected to represent most accurately the voice of the participants.

Participant Descriptions

Jackie is a first-year high school Geometry teacher in her early 20s. She is currently teaching under a temporary license and has not yet taken her state licensure exams. She has had no prior training on technology integration or using mobile devices in the classroom. She does not use mobile devices because she does not think they are a good idea. She

occasionally has students use the five desktop computers in her classroom. She sometimes browses the web to look for activities to use in her classroom.

Katie is a third-year high school science teacher in her late 30s. She did not graduate from a teacher education program. She has her students use mobile devices for research and utilizes virtual labs extensively. She also uses QR codes in her assignments and handouts that provide links to additional resources.

Amy teaches English as a developmental language at a high school. She has taught for 31 years, 14 at her current high school. She is in her late 50s. Her students have had anywhere from two months to one year of English. All of Amy's students use their phones or classroom mobile devices to complete learning tasks. They also use Google Translate on their devices to communicate with each other when working in groups. Apps like Google Translate are critical for students in Amy's class, where students speak a variety of languages and are trying to use Google Translate for Spanish to English translations.

Sandra is a career changer who previously worked in marketing. She took the required coursework to earn her teaching certification four years ago, but did not graduate from a teacher education program. She teaches seventh-grade language arts. Sandra is in her 30s. She has a teacher iPad and wishes all of her students had iPads as well. At a minimum, she would like to have at least five iPads in her room all the time. Once a week, Sandra reserves the cart of twelve laptops to use in her classroom. She stated that her school has carts of laptops and Microsoft Surface tablets available for teachers to reserve for classroom use. She also mentioned that every teacher at her school was given Apple TV for use in their classroom and it has been very helpful. Sandra's school provides a Flocabulary subscription and Sandra pays for her own Quizlet subscription.

Emma is an eighth-grade physical science and health teacher. She has been teaching for three years. Emma has a degree in science, but did not graduate from a teacher education program. She took the required coursework to earn her teaching certification. Emma is in her late 20s. Her Apple TV was not working in her classroom. Emma stated that science classes at her school have access to laptops all the time, but she only uses them one or two days a week. The science department also has a set of 12 iPads that are kept in her classroom, but they can be reserved by any of the science classes in the middle school. Emma wishes she had a class set of iPads available to her all the time.

Kaylee teaches sixth-grade science to English language learners (ELL) and students with disabilities. She is in her late 20s. This is her sixth year teaching, but her second year teaching at a middle school. She was an elementary school teacher for four years previously. She earned her degree with a dual major in science and education. She has her own set of 12 laptops and uses them with the students three to four times a week. Kaylee uses her teacher workstation to project what is

on students' screens to go over work with them and the whole class watches also.

Brenda is a graduate of an early childhood education program and has been a kindergarten teacher for five years. Brenda is in her late 20s. She has five classroom iPads plus a teacher iPad that are available to her for one week every six weeks because she shares them with the other kindergarten teachers in her school. Brenda has learning stations all around the room and her students are using technology in all but one station. She says her kids know how to use the iPads but do not know how to use the desktop computers in her classroom. They especially do not know how to use a mouse or how to double-click because they are used to mobile devices. Brenda uses Mimeo mobile to project a game from the teacher workstation that the district provides. She uses Mimeo mobile to project from her iPad also.

Selma has an undergraduate degree in elementary education and a graduate degree in curriculum and instruction. She has been teaching fourth grade for 5 years and is in her early 30s. Selma has two personal iPads and about five of her students bring in their own iPads. Selma's students work in pairs or small groups with the iPads, which they use daily. Every classroom also has a set of desktop computers. Selma feels iPads make it easier for them to find and research information and allows them to collaborate.

Arianna is a career changer. She retired from a marketing career and then took classes online to earn her teacher certification. She was previously a parent volunteer at the school and that is how she became interested in teaching. She is a third-grade teacher in her 40s and has been teaching for two years. With the district's encouragement, she is an active Twitter user and posts photographs and updates about the learning activities going on in her classroom. She also extensively uses the district's Discovery Education online resources because students can access these resources at home as well as in the classroom.

Joy is a second-grade teacher who did not graduate from a teacher education program. She took online courses to earn her teacher certification. She is in her 20s and this is her third year teaching. She has learned about technology integration through Title 1 school grants that have provided her with devices and technology tools to use in the classroom. She feels LiveScribe works well for lower grades and lower-level students to practice sight word cards and self-check answers. Joy has students in her class with learning disabilities and she feels using technology helps them feel like she is sitting right there with them when they are working in different classroom stations. She stated that technology also helps her with formative assessment.

Laura is a graduate of a teacher education program and has been teaching fourth grade for four years. She is in her 20s. She has had some technology professional development, but has learned most of what she knows on her own. She has ten mini iPads she shares with other classrooms and uses them

with her students three times a week. She also has an iPad for herself. She sometimes has her students work on the desktop computers in her classroom. Laura stated she would love it if all of her students had iPads. She feels technology benefits her students because it is hands-on. She also mentioned students find it easier to look up information with technology.

Grace is in her 30s and has been teaching fourth grade for five years. She is alternatively certified. Grace is one of the technology leaders at her school. She uses her teacher iPad in class every day. Her students share five iPads in class every day. She also has Apple TV in her classroom. She learned a lot about technology from a grant related to Universal Design for Learning. She has also presented about technology at the annual Future of Education Technology Conference.

Jordan is an eighth-grade science teacher in her 30s. She is a graduate of a teacher preparation program and has been teaching for seven years. Her students use the classroom laptop cart several times a week to access the district's Discovery Education learning resources.

Paula is a seventh-grade English language arts teacher and is a graduate of a teacher education program. She is in her 40s and has been teaching for 15 years. She uses Kahoot to formatively assess her students, who access the program with either their own devices or the classroom laptops.

Victor is an eighth-grade English language arts teacher in his late 20s. He graduated from a teacher education program. He has been teaching for 6 years. He hears all sorts of technology idea through several professional organizations he belongs to, both online and in the district. He is a member of the district's digital leaders organization and regularly hears about new technology this way.

Kathy is a sixth-grade science teacher in her 50s. She has been teaching for 20 years. She originally started at the elementary level. Prior to becoming a teacher, Kathy was a biologist. She did not graduate from a teacher education program. She does not do any collaborative work with digital learning in her classroom. She takes her students to the computer lab once a week for exams or research. Kathy sometimes lets her students use their phones for the calculator or the stopwatch when they do experiments. She has gone to technology professional development offered by the district, but finds it not applicable. She stated that she mostly explored on her own or hears about technology from other teachers.

Lisa is a seventh-grade science teacher who has been teaching for 19 years. She also teaches education courses at the local community college. She takes her students to the computer lab once a week, where they can work alone or in pairs. Her goal is to teach high school or in higher education. Lisa is in her 40s. Lisa feels lucky to have so many computer labs available at her school because she can always reserve one. Her husband works at a different middle school and he is only able to take his students into the computer lab once or twice a semester.

Jenn is a fourth-grade teacher who has been teaching for five years. She is in her 20s. She is a graduate of a teacher education program. Jenn stated that she could not imagine not having graduated from a teacher education program. She checks out two carts of iPads, a total of ten, at least once a week. Her school has four carts available. She feels she has learned the most about technology on her own. She stated she has learned the most about technology on her own. Pinterest is a favorite. Her dream is for each of her students to have their own iPad.

Kara is a fourth-grade teacher who graduated from a teacher education program. She is in her 20's. This is her fourth year teaching. She does not get the iPads every week because other teachers are checking them out. She probably gets them about 20 times a semester. Kara remarked that it depends on how far in advance you can plan your lessons so you can reserve your iPads. She would like for her students to each have their own iPads, especially for things like Socrative. She mentioned she is interested in our final report because she would love to talk to other teachers about what they are using for technology in their lessons.

Vera is a third-grade teacher in her 20s. She has been teaching for five years and is a graduate of a teacher education program. She has a teacher iPad and ten class iPads that she either bought or had donated through her mother's social club. Only some of her iPads have cases. She has bought the cases on her own also so she is waiting until cases go on sale before she buys more. She only wants to buy the cases that are "kid-proof." She and her students use iPads every day. Sometimes Kara will check out more iPads so every student can have one. She does most of the technology integration on her own, even creating lessons using the iPads.

Ben is a middle school technology teacher. He has been teaching for eight years. Ben is in his 30s. He has a computer design degree and got his teaching certification by taking online courses. He stated that his principal requires that teachers use Blackboard for their assignments and homework but he finds the storage space runs out halfway through the year and it becomes useless from that point forward. His students do not use their own devices in his classroom. He has tablets in his room but he does not use them because he teaches in the computer room and has more than enough desktop computers. He prepares his students to take and pass the Microsoft Office certification exams and the Adobe Photoshop certification exam.

Louise is a seventh-grade social studies teacher. She has been teaching for 30 years and is in her early 60s. She graduated from a teacher education program. She has five classroom iPads but is a team leader so she has access to all of the seventh-grade iPads. She feels iPads are the tool that is most useful in the classroom. She said the teachers at her school have had Apple TVs for almost four years, but they are still not installed because they are waiting for the district to do it. Louise stated that when they get new iPads the district has to put their "district stuff" on them and it takes forever to get them back. She believes the "other tablets" are useless, they

need iPads; and she stated that it would be great if all of her students had their own iPads.

Mary is in her second year of teaching sixth-grade English language arts. She has her alternative teacher certification from another state. She is a former lawyer who changed careers and became a teacher because of her children. Mary is in her 40s. She has two children at the school where she teaches. She prepares her students to take and pass the Adobe Photoshop certification exam. She believes strongly in using technology in her classroom but would like the students to have more devices.

Barb is a high school English teacher in her 20s. She is in her second year of teaching and did not graduate from a teacher education program. She stated that she has not been taught how to integrate technology into the classroom. She does use a teacher iPad to display content on the projector, but does not allow students to use devices in her classroom. She does allow students to access one of the five desktop computers in her classroom when they are doing research or are finished with their “regular work.”

Nick is in his fourth year teaching high school science. He graduated from a teacher preparation program. He is in his 20s. Students in his classroom who do not have their own devices sign out a laptop from a cart in his classroom. Most of Nick’s students have their own devices. Nick stated that he is a “techie” so he is always looking to gamify the classroom. He uses his mobile phone to control the overhead screen remotely. Eventually Nick would like a “green” or paperless classroom. He says this is the future.

Tess teaches high school math to English language learners. She has been teaching for 21 years and is in her 40s. Last year, Tess won a Golden Apple award and used her grant money to buy a class set of 30 Kindles. She purchased her own clickers to use for formative assessment because she stated the district’s clickers were too “glitchy.” Tess does not go to the district professional development on technology because what they teach is too broad for her to be usable. She wants to use apps specific to math and see them in action. Tess stated that next year she will use MS Recorder and a Surface tablet pro to record her lessons (audio and video). This will allow her to make her lessons available to students after class. She explained that the school would not buy her a Surface tablet so she is going to beg her brother-in-law to buy her one.

Themes

Given the intimate nature of findings and interpretations in qualitative research, these are presented together below. The themes included (a) teacher perceptions differed from administrator perceptions with regard to technology support, (b) teachers believe iPads are the most useful technology device in the classroom, (c) technology integration allows for more student-centered activities and enhanced teaching practices, (d) teachers are integrating technology using a wide variety

of instructional strategies, and (e) teachers are learning about technology organically.

Differing Perceptions on Technology Support

Teachers and administrators had differing perceptions on the district’s support of the digital learning implementation, for both device support and in teacher professional development. The digital learning implementation was initiated at the district level in collaboration with principals. District instructional technology specialists worked closely with school principals to develop a training and implementation plan that all stakeholders felt would be effective. Interviews conducted with eight school principals revealed that all of them felt the district was extremely supportive in implementing the digital learning initiatives. School administrators also felt the district was providing excellent technology support to their school staff. One principal commented, “If we did not have a teacher on staff who could explain a specific application or device, it would only take a phone call to the district to have someone here for training”. Another said, “Our school district sort of paved the road and launched us into digital leaders. They’re there to provide us with the support we need”. Teachers seemed to regard technology support differently. Jackie commented, “I had no prior training with technology or mobile devices. I don’t really think mobile devices are necessary in the classroom. If I have to use technology, I just find my own websites.” Tess stated, “I don’t go to the district professional development because what they teach is too broad for me to be usable. I want to use apps specific to math and see them in action”. Sandra mentioned she had not yet figured out ways to use her teacher iPad in the classroom and she wishes there was more support specifically for the iPads. She also shared her frustrations with the district-owned Microsoft Surface tablets. She commented, “I spend all this time planning a lesson using the Surface tablets and then they don’t connect to the Internet or they don’t work”. Vera felt isolated from how other teachers in the district were using technology in their classrooms. She commented, “I’d love to see your report because I want to know what other teachers are doing with technology in their classrooms.” Ben stated that his principal requires teachers to use Blackboard for their coursework and assignments, but “the storage space runs out halfway through the year and it becomes useless from that point forward.” Lisa said, “When we do get new iPads the district has to put their ‘district stuff’ on them and it takes forever to get them back. I’ve been using my own set of three iPads in the classroom because I’m still waiting to get the school-owned iPads back from the district technology people”. Emma said, “I was going to show you how I use my Apple TV, but it’s not working right now and I didn’t have time to try and fix it before class started.” The district’s Discovery Education subscription allows students to use a feature called

Board Builder which allows students to merge their own research, writing, and content creation with existing Discovery Education resources to electronic create boards. Louise stated she tried to have her kids create their own Discovery Education boards but “the system was too glitchy.” Louise added that the Discovery Education representative had spent the day in her classroom and it was still very problematic. Louise also mentioned, “the teachers in my school have had Apple TV’s for almost four years but they’re still not installed because we’re waiting for the district to do it.”

Teachers’ Device Preferences

Teachers interviewed felt that iPads were the most useful technology device in their classroom. Every classroom visited had at least five desktop computers in the classroom and additional computer carts that could be reserved. However, classroom observations demonstrated iPads being used by teachers and students more than any other device. Many seemed to have little regard for the other technology devices that had been provided to them. Jenn explained that she checks out two carts of iPads at least once a week. “My dream is to have each kid have his or her own iPad,” she remarked. Kara echoed Jenn’s sentiments. “I’d like for each of my kids to have their own iPads, especially for things like Socrative”. Kara said she is not able to get access to the iPads every week because other teachers are checking them out. “I try to plan out my lessons as far in advance as I can so I can reserve the iPads before others”. Vera uses her iPads every day. She has ten of her own iPads that she either purchased or had donated. Vera also tries to check out the school iPads so every student can have one. Only some of Vera’s iPads have cases. She has purchased the cases on her own so she is waiting for them to go on sale before buying more. Laura has ten mini iPads that she uses three times a week, plus her own teacher iPad. Her students share iPads with headphone splitters. Laura stated, “I would love it if all of my kids had their own iPads.” Grace uses five iPads in her classroom every day. Grace commented, “I wish I had more iPads available, I’d use them every day.” Brenda has five classroom iPads plus her own teacher iPad. They are available to her for one week every six weeks because they are shared among the other kindergarten classrooms in her school. She stated, “I wish we had iPads for every student. I have five desktop computers that my kindergartners don’t even know how to use because they can’t use a mouse. They’re so used to using iPads at home!” In Selma’s class, students use iPads every day. Selma has two personal iPads and five of her students bring in their own, so they have enough to pair. A student in Selma’s classroom shared, “I wouldn’t like it if we each had our own iPads because I like being able to pair up”. Selma reflected that iPads make it easier for her students to research and allow them to collaborate more often. Sandra has a teacher iPad and wishes all her

students had one as well. Sandra shared, “I’d love to have at least five iPads in my classroom rather than using my cart of 12 laptops once a week”. Emma has twelve iPads in her middle school science classroom, but they are shared among all of the science classes in grades six through eight at her school. Louise stated, “The district doesn’t recognize that iPads are the most useful technology tool in the classroom”. Louise, like most of the teachers interviewed, felt the tablets were useless and it would be great for each student to have their own iPad.

Benefits of Technology Integration

Classroom observations and teacher interviews revealed the digital learning initiative has allowed for more student-centered activities and enhanced, innovative teaching practices. Tess uploads her PowerPoint presentations to a shared location. Her high school students then use Kindles to annotate right on her presentation throughout class. Students then have the ability to email their annotated notes to themselves. Tess records her lectures with Microsoft Recorder and makes them available for her students to review outside of class. Tess also uses clickers she has purchased to do formative assessment. Student participation during these formative assessments is automatically uploaded into the district’s online Gradebook system. Nick uses his mobile phone to remotely control the overhead screen so he is able to walk around his high school science classroom. “Walking around allows me to keep an eye on what the students are doing with their mobile devices,” he said. Kaylee had her students use string tied to Barbie dolls to plot data on their mobile devices. The mobile devices were necessary because students had to be on the first and second floors to drop their doll and measure the string to plot the data, and then quickly measure that data point against the shorter string and different-sized dolls. In Amy’s classroom, her students have between two months to 11 months of experience speaking English. Her students use Google Translate on mobile devices to communicate with each other. One of her students speaks a Mayan language that is only spoken by 450,000 people in Guatemala. The language is limited to agricultural terms so she did not have a large vocabulary in any language when she began school in the USA less than a year prior. The student now lives with a Spanish-speaking uncle and is able to use Google Translate on her mobile phone to collaborate with other students and communicate with Amy. During classroom observations, Selma’s students acted as ambassadors for the technology they use. They wore signs with the names of the different apps they use for learning in the classroom. They were able to explain the apps, how they used them, and what they learned from them. Arianna’s students watched a video with astronaut Scott Kelly, who was tweeting from space. Arianna asked her students, “What is the purpose of tweeting?” One student

answered, “Informing other scientists about what is currently happening.” Students in Arianna’s third-grade classroom also watched a Discovery Education video about a cockroach. When they asked to watch it again, Arianna reminded them that they could log in to Discovery Education at home and watch the video again. Laura’s fourth-grade students use iPads to create paper slide videos, upload them into iMovie and add features, and save them in a central location that Laura then accesses to upload the student videos to YouTube. In Fig. 1, Brenda uses her iPad loaded with Mimeo mobile to project a learning game to Mimeo board while she works on math problems with another group of students at a different station in her kindergarten classroom.

Instructional Strategies

Teachers are implementing technology using a wide variety of instructional strategies. Classroom observations revealed teachers and students using apps like Kahoot, Quizlet, and Padlet for content review and formative assessment, Powtoon for animated literacy lessons, and Google Docs for collaboration. Kindergarten teacher Brenda shared, “I got a Live Scribe pen and used iPads to record myself reading a book and create guided reading activities. I feel LiveScribe works well for lower grades and lower level student activities, such as sight word cards and self-check answers. I also have an ESE cluster and using iPads I feel they’re getting me at every station, even when I’m not sitting right there”. Grace explained, “I have my fourth graders group up at different tables to do jigsaw activities, such as; on computers to do a

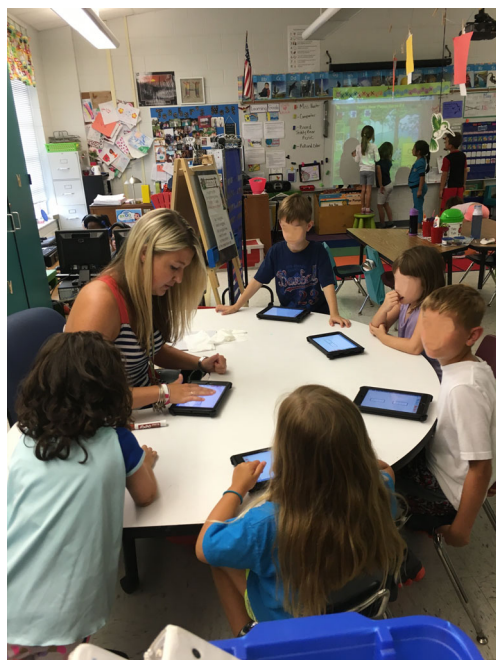


Fig. 1 Digital learning in a kindergarten classroom

Discovery Ed activity, work on e-reader activities with me, iPads, laptops, and LiveScribe pen.” In Jenn’s fourth-grade classroom, students used iPads and QR codes to do a group math review. Jenn mentioned that she uses Educreations, Socrative, Kahoot, and QR Codes regularly for review activities and to conduct formative assessments. The students in Vera’s third-grade classroom use Class Kick on their iPads to practice math. Class Kick allows Vera to see each student’s work. Vera mentioned that she has an English language learner (ELL) classroom, which means English is not the first language or the language spoken at home for most of her students. Most of her students speak Spanish. During a classroom observation, ELL students worked in pairs to solve math word problems in Class Kick. Each student had an iPad. One used Google Translate to convert the English word problem to Spanish. The other worked to solve the math problem. Periodically, the students would re-play the audio translation as they worked. The partners took turns using Google Translate and Class Kick. Vera said, “I use the kids and technology as translators all the time. I don’t have an ELL aide in my classroom and I don’t speak Spanish. The technology allows them to work towards the learning goals despite the language barrier.” Fig. 2 shows students in Vera’s class working together using Class Kick and Google Translate on iPads to solve math word problems.

Learning Organically

Teachers are learning about technology organically. Organized professional development for the digital learning initiative does not seem to be the way teachers are learning about technology. This is despite the district having a robust network infrastructure, an Instructional Technology department that provides a host of training and subscription resources, a bring your own device (BYOD) policy, and school-based administrators who indicate they embrace and support digital learning. Victor said, “I hear all sorts of ideas about how to use technology in the classroom. I go to all the district meetings and am a member of the district’s digital leaders group. But, I learn the most from online blogs or



Fig. 2 Students using iPads to solve math word problems

Pinterest”. Kathy has gone to district professional development for technology, but has not found it applicable to her. She remarked, “I’ve explored on my own or heard things from other teachers”. Kathy told me that her students use technology once a week when they visit the computer lab. However, observations in the computer lab showed students taking online quizzes in the computer lab while Kathy sat at her desk. Lisa said she has not attended any technology training, but her students go to the computer lab once a week where they complete lessons from the Think Central website. She said she lets her students use their phones in the classroom to “look stuff up or to play Kahoot”. Nick identified himself as a “techie” and said he is constantly looking at ways to use technology in the classroom on social media sites like Pinterest. He said, “I don’t really need the district training because I’m learning on my own”. Vera said she learns the most about technology on her own. She commented, “I’ve bought and tried a ton of apps. I usually create my own lessons for the iPad.” Grace and Joy both say they have learned most of their technology integration skills from a grant each received for this purpose. They now use a variety of digital learning tools, such as Live Scribe, Educreations, ShowMe, Brain Pop Jr., Discovery Education, and QR codes.

Discussion

The purpose of this study was to explore a digital learning initiative implementation in a public school district in southwest Florida in order to provide formative feedback to guide its digital learning initiative beyond the initial three-year implementation. Of the 26 teachers interviewed, ten mentioned district technology support and professional development offerings needed improvement. Out of the eight administrators interviewed, all of them felt the district’s support had been and continued to be exemplary. Twenty of the 26 teachers interviewed mentioned their preference for using the iPad as both a digital learning tool and a teacher tool. Fifteen wished for an iPad for every student in the class, available every day. Jenn said, “My dream is for every student to have their own iPad”. Laura stated, “The iPad is by far the most useful digital tool in my classroom. I wish the district would go 1:1 with iPads.”

The teachers who have implemented digital learning activities into their classroom are doing so in ways that allow students to communicate, collaborate, think critically, and be creative. In 16 of the 26 classrooms observed, students exhibited use of these twenty-first century skills while using digital tools (Partnership for 21st Learning 2015). According to the Partnership for 21st Learning (P21) framework, students should be able to communicate and collaborate utilizing multiple media and technologies and in diverse, multi-lingual environments (2015). In Kara’s fourth-grade classroom, students work in small groups to complete a scavenger hunt using QR codes and iPads. They have to work together with their digital tools to complete the scavenger

hunt. Once they have collected all of their electronic clues, they again work in small groups to create a paper slide video using microphones, a headphone splitter, and the iPads. Each student assumes a role in the team (e.g., narrator, artist, researcher, writer, and producer) to complete the video. Once the video is recorded on the iPad, the student who acts as the producer uploads the video to iMovie. The teacher then uploads the video to YouTube where students can view each other’s work and also share it with their parents.

Teachers use a wide variety of instructional strategies and digital tools in their classrooms. The district’s Blackboard learning management system allows students and parents to easily access learning goals, expectations, content delivery, and assessment results. Joy and Grace use LiveScribe for guided reading activities in their second and fourth-grade classrooms. Joy said, “With the guided reading activities I’ve recorded my own voice so the students feel like they are getting me even when I’m at a different station”. Tamzon records her PowerPoint presentations and uploads them. During her high school math classes, students use their Kindles to annotate directly onto her PowerPoint during her lectures. They can then email their notes to themselves for later viewing. The observations in 26 classrooms revealed eight different devices being used by students; desktop computers, laptop computers, iPads, Microsoft Surface tablets, clickers, LiveScribe pens, and mobile phones. Most devices in use were district-owned. Over 25 apps were either mentioned by teachers or observed being used in the classroom. The most popular apps being used in elementary and middle school was Kahoot, followed by Discovery Education. In elementary grades, Brain Pop, Educreations, and QR codes followed these. In middle school grades, Socrative, Quizlet, and QR codes followed these. At the high school level, the most popular apps were Blackboard, Quizlet, iMovie, and the Microsoft Office suite of products (Word, Excel, and PowerPoint).

All 14 of the teachers who mentioned district professional development said they had learned most of what they know through sources outside of the district’s professional development offerings. Joy mentioned she learned about Educreations from a district training, “I’d like to use Educreations more but you can only save six videos without a license so I found Show Me and starting using that because you can save more videos”. Laura said, “I have gone to some of the professional development technology trainings at school, but I already knew the apps they showed, so I started doing most of it on my own”. Kaylee feels her education prepared her for technology integration so it is not necessary for her to go to technology training. She commented, “I have a dual degree in Education and STEM (Science, Technology, Engineering, and Math) and I have a minor in math and science. I learned all about technology in the classroom in school so I use what I already know”. Tamzon stated, “I don’t go to the district trainings because they’re too broad to be useable. I want to know how to use apps specific to math and I want to see them in

action”. Some of the teachers felt they were integrating technology for learning when students were observed simply using the technology. According to Polly and Hannafin (2010), “Teacher beliefs and practices are often misaligned; in many instances, teachers are unaware of these discrepancies (p. 566). In Kathy’s middle school science class, students went to the computer lab to take a computer-based quiz. She commented, “As you can see, my students come into this room once a week and use technology. I also let my students use their phones as a stopwatch when we do experiments in the classroom. So, we do use technology all the time.” Lisa felt her students had frequent access to technology. She remarked, “I bring my students to the computer lab once a week and they work on lessons from Think Central. I’m lucky they have access to so much technology.”

Limitations, Recommendations, and Conclusions

The limitations of this study are relative to all qualitative research. All of the participants were from one school district, which limits the ability to generalize these findings to larger populations. As such, these results should be interpreted with caution and the extent to which these results can be applied in other contexts is situated with the reader.

Based on the results of this study, recommendations include (1) ongoing communication about digital learning expectations and opportunities should be established between administrators and teachers, (2) administrators should consider collaborating with teachers about preferred devices and provide ongoing training for devices already owned, (3) shared practices including video examples should be established in a central repository as a professional development tool for teachers, (4) creation of a sustainable, reflective platform for teacher professional development in the digital learning environment should be established.

The promise of reaching full implementation of digital learning initiative will not become a reality without the teachers’ full support and a positive perception of professional development. Teachers should have opportunities to learn the technical and pedagogical skills to use technology and to integrate technology in their teaching (Gura and Percy 2005). Teachers’ professional development programs should be designed to equip teachers with technical skills and pedagogical knowledge to implement the digital curriculum. It should be sustainable and ongoing.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

- Abel, N. (2016). What is personalized learning? [Blog post]. Retrieved from <https://www.inacol.org/news/what-is-personalized-learning/> Accessed 2 October 2017.
- Adams Becker, S., Freeman, A., Giesinger Hall, C., Cummins, M., & Yuhnke, B. (2016). *NMC/CoSN horizon report: 2016 K-12 edition*. Austin: The New Media Consortium.
- Afshari, M., Ghavifekr, S., Siraj, S., & Jing, D. (2013). Students’ attitudes towards computer-assisted language learning. *Behavioral Sciences, 103*, 852–859.
- Bogdan, R. C., & Biklen, S. K. (2003). *Qualitative research for education: an introduction to theories and methods* (4th ed.). New York: Pearson Education Group.
- Bonanno, P. (2011). Developing an Instrument to Assess Teachers’ Readiness for Technology-Enhanced Learning. Paper presented at 14th Annual International Collaboration for Learning: ICL. <https://doi.org/10.1109/ICL.2011.6059622>.
- Creswell, J. (2003). *Research design: qualitative, quantitative, and mixed methods approach*. Thousand Oaks: Sage Publications.
- Creswell, J. W., Hanson, W. E., Clark, P., Vicki, L., & Morales, A. (2007). Qualitative research designs: selection and implementation. *The Counseling Psychologist, 35*(2), 236–264. <https://doi.org/10.1177/0011000006287390>.
- Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: a critical relationship. *Computers and Education, 59*(2), 423–435.
- Glaser, B. (1978). *Theoretical sensitivity: advances in the methodology of grounded theory*. Mill Valley: Sociology Press.
- Glaser, B. G., & Strauss, A. L. (1967). *Discovery of grounded theory*. Mill Valley: Sociology Press.
- Glesne, C. (2006). *Becoming qualitative researchers: an introduction*. Boston: Allyn and Bacon.
- Guba, E., & Lincoln, Y. (1988). Do inquiry paradigms imply inquiry methodologies? In D. M. Fetterman (Ed.), *Qualitative approaches to evaluation in education*. New York: Praeger.
- Gura, M., & Percy, B. (2005). *Recapturing technology for education: keeping tomorrow in today’s classrooms*. Lanham: Scarecrow Education.
- Honebein, P., Duffy, T. M., & Fishman, B. (1993). Constructivism and the design of learning environments: context and authentic activities for learning. In T. M. Duffy, J. Lowyck, & D. Jonassen (Eds.), *Designing environments for constructivist learning*. Heidelberg: Springer-Verlag.
- Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., & Ludgate, H. (2013). *NMC horizon report: 2013 K-12 edition*. Austin: The New Media Consortium.
- Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2014). *NMC horizon report: 2014 K-12 edition*. Austin: The New Media Consortium.
- Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2015). *NMC horizon report: 2015 K-12 edition*. Austin: The New Media Consortium.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills: Sage Publications.

- Merriam, S. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.
- Merriam, S. (2009). *Qualitative research: a guide to design and implementation* (2nd ed.). San Francisco: Jossey-Bass.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: a sourcebook of new methods* (2nd ed.). Thousand Oaks: Sage Publications.
- Partnership for 21st Century Skills. (2015). *P21 framework definitions*. Retrieved from http://www.p21.org/storage/documents/docs/P21_Framework_Definitions_New_Logo_2015.pdf Accessed 2 October 2017.
- Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Thousand Oaks: Sage Publications.
- Peshkin, A. (1988). In search of subjectivity: one's own. *Educational Researcher*, 17(7), 17–21.
- Polly, D., & Hannafin, M. J. (2010). Reexamining technology's role in learner-centered professional development. *Educational Technology Research and Development*, 58(5), 557–571.
- Ruggiero, D., & Mong, C. J. (2015). The teacher technology integration experience: practice and reflection in the classroom. *Journal of Information Technology Education Research*, 14, 161–178.
- Sabzian, F., & Gilakjani, A. P. (2013). Teachers' attitudes about computer technology training, professional development, integration, experience, anxiety and literacy in English language teaching and learning. *International Journal of Applied Science and Technology*, 3(1), 67–75.
- Shuler, C. (2009). *Pockets of potential: using mobile technologies to promote children's learning*. New York: The Joan Ganz Cooney Center at Sesame Workshop.
- Singh, T. K. R., & Chan, S. (2014). Teacher readiness on ICT integration in teaching-learning: a Malaysian case study. *International Journal of Asian Social Science*, 4, 874–885.
- Summak, M., Baglibel, M., & Samancioglu, M. (2010). Technology readiness of primary school teachers: a case study in Turkey. *Procedia Social and Behavioral Sciences*, 2, 2671–2675.
- Wolcott, H. (1994). *Transforming qualitative data: description, analysis and interpretation*. Thousand Oaks: Sage Publications.
- Yin, R. K. (1984). *Case study research design and methods*. Beverly Hills: Sage Publications.
- Yin, R. K. (2014). *Case study research: design and methods*. Los Angeles: Sage.