Education and Information Technologies
https://doi.org/10.1007/s10639-022-10920-0

Exploring technology readiness and practices of kindergarten student-teachers in Saudi Arabia: A mixed-methods study

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Received: 17 July 2021 / Accepted: 27 January 2022

Abstract
This study aims to explore kindergarten student teachers' readiness to integrate technology into their future classrooms and factors affect their integration. A mixed-methods, sequential explanatory design was utilized to achieve the research purposes. There were two phases. The first phase conducted a survey to assess technical and pedagogical readiness levels as well as participants' pedagogical attitude and opinion toward technology integration. The second phase conducted follow-up interviews to understand how participants intended to transfer their intentions into practice and factors affect their technology integration. The first-phase results showed that participants were ready to implement technologies while having positive attitudes toward technology integration. The second-phase results confirmed all participants were able to transfer their technical skills into professional practice. However, few were ready to practically apply their pedagogies. The results indicate three main factors, including technological resources, the school infrastructure, and the number of students in their classrooms. It is recommended to improve teacher preparation program to develop teacher technology readiness.

Keywords Technology readiness · Saudi Arabia · Students-teachers · Kindergarten

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Published online: 25 February 2022

1 Introduction

As young children become increasingly interested in using technology, the field of education must become more flexible and responsive to the dynamic changes caused by this rapid technological growth. Further, pedagogies need to consider the resulting challenges from rising levels of global competition. Organizations such as the National Association for the Education of Young Children (NAEYC), Fred Rogers Center for Early Learning and Children's Media, the International Society for Technology in Education (ISTE), and Australia's Statement on Young Children and Digital Technologies (Early Childhood Australia [ECA], 2018) provide guidance on how technology can be integrated into the education of young children. This guidance includes comprehensive plans to prepare teachers to become digital citizens, and focuses on supporting them in developing digital activities, using media to connect with parents, and using technology in their daily teaching practices (NAEYC & Fred Rogers Center, 2012; ISTE, 2015; ECA, 2018). Many studies on early childhood education have emphasized the importance of exploring teachers with technical and pedagogical knowledge and skills designed to support learning (Moore & Adair, 2015; Brown & Englehardt, 2017).

Despite global and national campaigns to integrate support technology into classrooms, previous research has reported a lack of technology use in primary education settings around the world (Hu et al., 2019; Danniels et al.,2020). A great deal of research has investigated the factors that impact the integration of technology into early learning contexts (Knezek & Christensen, 2016; Tondeur et al., 2017; Farjon et al., 2019; Alkhayat et al., 2020). Studies reveal that while student-teachers have a good level of technical skills, they often need support on pedagogical skills (Tondeur et al., 2017; Alkhayat et al., 2020). In the light of this, this study aims to investigate Saudi kindergarten student-teachers' readiness to integrate technology into their future classrooms. This study also extents to explore the factors that affect their integration.

Technology readiness is defined as "people's propensity to embrace and use new technologies to accomplish goals in home life and at work" (Parasuraman, 2000, p. 308). For educators, technological readiness includes an educator's awareness of, knowledge of, perceptions of, and attitudes toward technological integration (Msila, 2015). Technical and pedagogical readiness are the two important components for the success of technology integration in teaching and learning (Ng, 2011). In the current study, technical readiness is considered the extent to which student-teachers have the basic skills that are needed to teach using technology in the classroom, and pedagogical readiness is the extent to which student-teachers are able to maintain best teaching practices while integrating technology to enhance students' learning.

1.1 Literature review

This section presents a review of the literature surrounding the topic of technological readiness in early childhood education. It starts with a review of the use of technology in early childhood education. Next, there is a discussion of the technological readiness of student-teachers. The final two sections of the review focus on transi-

tioning from a state of readiness to using technology in the classroom and the factors that affecting technology integration in the classroom.

1.2 Technology in early childhood education

The effective use of technology in childhood education has the potential to help children learn and transition to the school environment (United States Department of Education, 2017). Specifically, technology in the classroom enhances cognitive and social development (Gottschalk, 2019). Studies have shown that technological integration can facilitate collaboration (Martín et al., 2018) by encouraging children to cooperate when attempting to solve problems (Beschorner & Hutchison, 2013; Lee, 2015) and enhancing discussion and communication with teachers and peers (Goodreau, 2013; Flewitt et al., 2015; Lee, 2015). Additionally, it can enhance the development of academic skills such as reading, writing, and mathematics (González-González et al., 2019).

1.3 Technological readiness among student-teachers

New teachers who have spent their childhood years surrounded by technology typically develop related technical skillsets (Bate, 2010). Previous studies have found that student- teachers are typically proficient with technologies such as word processing programs, e-mail (Whetstone & Carr-Chellman, 2001), educational software (Iding et al., 2002), social networking tools (Doering et al., 2008) and Web 2.0 tools (Sadaf et al., 2016; Alkhayat et al., 2020). Newly trained teachers with such skill sets are likely to be more open to the idea of integrating technology into the teaching practice (Goe et al., 2011).

1.4 Transitioning readiness into practice

Previous studies have investigated whether student-teachers are ready to implement their technical (Sadaf et al., 2016; Alkhayat et al., 2020) and pedagogical (Korthagen et al., 2006; Choy et al., 2009; Bate, 2010) training in the classroom. Sadaf et al. (2016) for example, explored whether student-teachers were ready to transition their knowledge of Web 2.0 tools into professional practice. This study found that the majority of participants were able to do so. Specifically, they were able to use video editing/sharing tools instead of blogs or Wikipedia. A similar study was conducted by Alkhayat et al. (2020) to explore early childhood student-teachers' perceptions using Web 2.0 tools. This study too found that student-teachers were able to integrate Web 2.0 technology, especially YouTube, Instagram, WhatsApp, and Twitter into their future classrooms. However, other studies have found that student-teachers face difficulties when transitioning their pedagogical skills from pre-service education to professional practice (Korthagen et al., 2006; Choy et al., 2009; Bate, 2010). For example, Koc and Bakir (2010) found that technology was used for drills and practice exercises rather than for engaging learners in student-centered learning. Similarly, Tondeur et al. (2017) found that only a limited number of the student- teachers participated in their study were able to use technology to support a student-centered

approach and no participants were able to use technology to support 21st-century skills related to collaboration, creativity, and critical thinking. Therefore, the researchers suggested that preparation programs should focus on the implementation of pedagogical skills and knowledge. Another study by Alkhayat et al. (2020) found that their student-teachers felt that they were not prepared to use Web 2.0 technologies because their teacher preparation program only taught them the basic technical skills (e.g., Word and PowerPoint); thus, that they felt they still needed more support to integrate such technologies into their future classrooms.

1.5 Factors affecting technology integration

Previous studies have found that pedagogical attitudes and beliefs are the main factors contributing to the successful use and integration of technology among student-teachers (Knezek & Christensen, 2016; Tondeur et al., 2017; Farjon et al., 2019; Alkhayat et al., 2020). Research has shown that student-teachers who have positive pedagogical attitudes and beliefs are more likely to integrate technology into the classroom setting (Hammond et al., 2009). Specifically, student-teachers who believe in the value of technology for enhancing student learning are likely to use various technologies in the classroom (Liu, 2011; Buquoi et al., 2013; Alkhayat et al., 2020). Additionally, student-teachers with student-centered beliefs and constructivist ideals have been found to effectively integrate technology (Mama & Hennessy, 2013; Hsu, 2016; Admiraal et al., 2017). While many student-teachers hold these positive attitudes, there still seem to be few instances of classroom implementation among the new generation of teachers (Bate, 2010; Agyei & Voogt, 2011; Luo et al., 2020). Several studies have investigated the reasons for such limited technology uptake among student-teachers and new teachers (Dawson, 2008; Bate, 2010;), with many findings that school culture and characteristics (e.g., infrastructure) influence integration (Choy et al., 2009; Sadaf et al., 2016; Alkhayat et al., 2020). Specifically, the student- teachers participated in a study by Choy et al. (2009) revealed that although they had positive attitudes regarding the integration of technology to support student-centered learning, they were unable to transfer their intention into action due to a lack of technological resources. Similarly, Sadaf et al. (2016) found that student-teachers had positive attitudes toward Web 2.0 tools and believed that these tools support students' learning and engagement; however, some student-teachers were unable to use these tools because there was limited access to technological resources. Bate (2010) revealed that school culture also had a major effect on the levels of support given to student-centered learning.

1.6 Study context

The Saudi education system has undergone several reforms designed to improve the quality of education at all grade levels, including early childhood. Specifically, the second objective of the 10th Development Plan for the Ministry of Education (MOE) stipulates that teachers must be qualified in certain areas of professional development, while the seventh strategic objective focuses on the need to strengthen "the capacity of the education system to meet the needs of the market" (Ministry of Edu-

cation [MOE], 2019). These measures are also aimed at achieving the goals outlined by Saudi Vision 2030, which emphasize the importance of developing a policy that enhances teacher preparation. These initiatives seek to improve teachers' digital competence and enhance their ability to integrate technology in learning contexts (Alghamdi & Holland, 2020). Professional and teaching competency guidelines established by the Saudi MoE state that "all teachers should be well prepared to utilize technology in educational processes which improve learning, provide an interactive learning environment, and facilitate communication between teachers, students, parents, and school leaders" (MoE, 2020).

In 2010, Saudi universities redeveloped their program for kindergarten teachers so that educational outcomes were more congruent with the National Qualifications Framework for Higher Education (2009) (Department of Kindergarten [DoK], 2015). Currently, such programs aim to support the use of technology in teaching and learning, thereby providing 'student-teachers with skills that help them design educational and technological aids and educational activities for children' (DoK, 2015). In 2018, the MoE also began to redevelop teacher preparation programs by collaborating with Saudi universities (MoE, 2020). Reflecting those efforts, this study investigated the effectiveness of current preparation programs for kindergarten teachers in regard to educational technology practice. The results of this study can be used to support decision-makers and curriculum designers in developing new preparation programs for kindergarten teachers. Further, this study revealed several factors that supported and/ or threatened classroom technology integration in the early childhood education context. Policymakers can use this information to facilitate the use of technology in the classroom setting. The following research questions were explored:

- Are Saudi kindergarten student-teachers ready for technology integration?
- To what extent do Saudi kindergarten student-teachers translate their intentions to integrate technology into their teaching practices?
- What factors influence Saudi kindergarten student-teachers when attempting to implement technology in the classroom setting?

2 Materials and methods

This mixed-methods study implemented a sequential explanatory design that was conducted in two phases. First, relevant phenomena were explored by collecting quantitative data through surveys, and qualitative follow-up interviews were then conducted among a small subsample (Creswell, 2014). The first phase was explanatory, and thus explored participant readiness to integrate technology into the classroom prior to actual practice. Participants were also asked about their pedagogical ideas and opinions about integration. The second phase was exploratory, and consisted of follow-up interviews to better understand how participants intended to translate their readiness for technology integration into practice and explore the factors that influenced this readiness (Fig. 1).

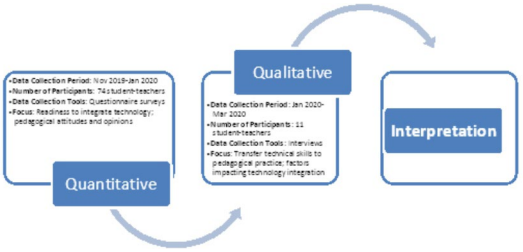

Fig. 1 Sequential explanatory design for the mixed-methods research model

2.1 Phase one

Phase one (quantitative) took place from November 2019 to January 2020. Participants in this study were surveyed during the first week of the second semester, just prior to the first stage of their professional practice (teaching practicum). The collected data produced strong evidence that was used to determine whether participants were ready to integrate technology at that time. Furthermore, this phase sought to explore student-teachers' pedagogical opinions about technology integration.

2.2 Phase two

Phase two (qualitative) took place from January to March 2020. It was conducted to better understand how participants intended to translate their readiness into implementing technology in their classroom practice. Participants were given six weeks to settle into their schools, and interviews took place directly following this period (February 2020). All interview questions were developed based on the analysis of the survey data collected in phase one.

2.3 Sample

The participants were female students from the college in eastern Saudi Arabia where the authors of this study work. All participants were in the final stages of completing their bachelor's degrees. They had completed their mandatory college courses and were ready for professional practice. They were also required to complete 14 weeks of professional practice prior to graduation (teaching practicum).

Of the total of 121 student-teachers enrolled in the final semester of their bachelor's degree, 74 completed online questionnaires during phase one, while a smaller subsample of 11 were interviewed during phase two.

2.4 Research tools

2.4.1 Phase one: survey

A review of the literature was conducted to find a suitable tool for this study. The Technology Readiness Survey (TRS) used in this study is a modified version of the survey developed by Al-Awidi and Aldhafeeri (2017). The new survey consisted of 29 closed-ended questions that were divided into four categories. The first section

contained three items asking for information about the target class, preferred teaching methods, and teaching experience, while the second part included 10 items concerning technical skills. The third section contained eight items related to pedagogical readiness for technology integration, and the fourth consisted of eight items regarding pedagogical attitudes and opinions. Answering methods included multiple-choice, yes/no, and a Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*.

2.4.2 Phase two: interviews

An analysis of the survey data collected during phase one was used to develop the interview questions. Semi-structured interviews were then conducted face-to-face with 11 of the original participants. All interviews were audio-recorded and hand notes were also taken. Participants were asked about their implementation of technical skills and pedagogical uses of technology in the classroom, as well as what factors they believed affected technology integration. Interview questions included: "How do you use technology in your teaching practice?" "Can you explain this further?" "What factors affect your ability to integrate technology into the classroom?" and "How do these factors affect your teaching?"

Each interview lasted between 15 and 20 min. The aim was to gain additional insight into how participants intended to transfer their technical and pedagogical skills into practice and explore what factors may have affected their integration of technology in the classroom.

2.5 Data analysis

IBM SPSS software (version 25) was used to analyze all survey data and produce descriptive statistics regarding the technical and pedagogical readiness as well as pedagogical attitude toward technology integration among participants. In terms of the analysis of qualitative data, all interviews transcripts were transcribed into word documents in the original interview language (Arabic). The documents were analyzed and then translated into English. This study followed the thematic "bottom-up" approach developed by Braun and Clarke (2006) for identifying, analyzing, and reporting patterns.

Table 1 Cronbach's alpha values

Items	No. of questions	Cronbach' alpha
Technical Readiness	10	0.86
Pedagogical Readiness	8	0.81
Pedagogical Attitudes and Opinions	8	0.87

2.6 Validity and reliability

The survey was piloted, and Cronbach's alpha values were checked. The survey was administered online via Google Forms. The link for the survey was sent to student-teachers, and seven student-teachers returned responses and their feedback was collected face-to-face.

Cronbach's alpha values were calculated to test the reliability of the survey questions. Values for Cronbach's alpha indicated high internal consistency greater than 0.7 (Table 1).

To establish the validity of qualitative data, a researcher must check for accuracy by employing strategies to search for rich and thick descriptive data (Creswell, 2014). This study therefore used a rich and thick descriptive dataset and maintained an audit of all analysis processes. Interviews were recorded and transcribed into text documents that were retained for recordkeeping.

3 Results

3.1 Phase one: key findings

Survey data were collected and analyzed from 74 participants during phase one. Here, findings are presented in three sections: general participant information, technical readiness, and pedagogical readiness.

3.2 General participant information

A total of 121 student-teachers were initially recruited from one college in eastern Saudi Arabia. Of these, 74 responded to the survey. Results showed that more than 35% had more than 26 students in their respective classrooms, while between 20 and 25% had more than 15 students. In terms of teaching experience, 73% had no experience teaching at the kindergarten level at the time of survey, and 60% had not received any professional development training.

3.3 Technical readiness

Participants were surveyed about several items related to their technical skills. The general findings presented in Table 2, indicated that the respondents had the technical skills needed for teaching while using technology.

Results showed that 63% strongly agreed that they were able to use devices connected to the Internet, 51% knew how to use social networking platforms, and 49% said they could communicate with others using e-mail. The results also showed that more than 52.7% could upload/download information via the Internet and present information using apps such as PowerPoint. A further 58% said they could use learning management systems, while approximately 43% agreed they were able to create educational blogs. 36% reported that they could use websites and Wikis, and 38%

Table 2 Student-teachers' technical readiness

	Survey items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	I am able to use devices connected to the internet.	62.2%	27%	10.8%	0	0
2	I am able to communicate using email.	48.6%	39.2%	10.8%	1.4%	
3	I am able to download and upload information via the Internet.	55.4%	40.5%	1.4%	1.4%	1.4%
4	I am able to present information using applications such as PowerPoint	52.7%	39.2%	4.1%	2.7%	1.4%
5	I am able to create educational blogs.	21.6%	43.2.6	23%	9.5%	2.7%
6	I am able to create educational websites and Wikis.	23%	36.5%	23%	16.2%	1.4%
7	I am able to use social network platforms.	51.4%	35.1%	8.1%	2.7%	2.7%
8	I am able to use Learning Management Systems (LMS).	32.4%	58.1%	8.1%	1.4%	0
9	I am able to transfer printed content into digital content.	24.3%	37.8%	27%	5.4%	5.4%
10	I am able to design online quizzes and use them in the classroom.	35.1%	44.6%	13.5%	6.8%	0

were able to convert written curricula into digital content. Finally, 45% agreed they could design online quizzes and implement them in the classroom.

3.4 Pedagogical readiness

Participants were surveyed about several items related to their pedagogical readiness to integrate technology. All items were rated on a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The final results presented in Table 3.

The findings indicated that the respondents believe they have a good grasp of the basic principles for pedagogical practices on integrating technology in learning and teaching processes. Specifically, 62% of participants agreed they could support engagement and communication among their students through technology integration. Furthermore, 60% agreed that they could use technology to motivate children by bringing real-life experiences to school and creating related digital activities. Further, approximately 57% agreed they could use technology to support their own teaching methods, while 55.4% agreed they could integrate technologies into teaching and learning activities and 53% of the participants agreed that they could use technology as both teaching and learning tools.

In terms of managing time in tech-equipped classrooms, results showed that approximately 54% of participants agreed they could do so, while 55% said they could sufficiently manage and observe children in a technology-enriched environment.

Table 3 Student-teachers' pedagogical readiness

	Survey items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	I am able to use technology to support teaching and learning.	33.8%	56.8%	8.1%	1.4%	0
1	I am able to integrate technology into teaching and learning activities.	40.5%	55.4%	2.7%	0	1.4%
2	I am able to use technology as a teaching and learning tool.	40.5%	52.7%	5.4%	0	1.4%
3	I able to use technology to support engagement and communication among children.	38.4%	62.2%	8.1%	0	1.8%
4	I am able to motivate children by bringing real-life experiences to school and creating related digital activities	24.3%	59.5%	10.8%	5.4%	0
6	I am able to manage my time in a tech-equipped classroom.	29.7%	54.1%	9.5%	4.5%	0
7	I am able to manage and observe students learning in a technology-enriched classroom.	28.4%	55.4%	10.8%	2.7%	0
8	I am able to integrate technology to enhance and motivate children.	31.1%	59.5%	9.5%	0	0

3.5 Participant attitudes and opinions on technology integration

Participants were presented with 8 items regarding their pedagogical opinions toward integrating technology into the classroom. These items were rated on a 5-point Likert

Table 4 Student-teachers' pedagogical attitudes and opinion

	Survey items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	I believe that technology supports collaborative work.	51.4%	36.5%	10.8%	1.4%	0
2	I believe that technology reduces the burden on teachers.	44.6%	39.2%	10.8%	2.7%	2.7%
3	Technology provides good tools for learners of different abilities.	45.9%	43.2%	8.1%	2.7%	0
4	Technology offers a good variety of learning activities.	40.5%	47.3%	9.5%	2.7%	0
5	Technology supports different learning styles.	44.6%	47.3%	6.8%	1.4%	
6	Technology helps teachers to facilitate learning rather than directing students.	56.8%	43.2%	0	0	0
7	Technology increases the development of new concepts.	41.9%	51.4%	6.8%	0	0
8	Technology helps students learn important concepts and ideas.	40.5%	54.1%	2.7%	2.7%	0

scale ranging from to 1 = *strongly disagree* to 5 = *strongly agree*. The final results presented in Table 4.

General results showed that almost all participants held very positive pedagogical attitudes toward technology integration. Specifically, 51.4% strongly agreed that technology supports collaborative work, while 44.6% said it reduced the burden on teachers. 46% strongly agreed that technology provides good tools for learners of different abilities, and 40.5% strongly agreed that it offers a good variety of learning activities. A further 44.6% strongly agreed that technology supports different learning styles.

Notably, participant responses to some items ranged from positive to very positive, with approximately 57% strongly agreeing that technology helped teachers facilitate learning rather than directing children (43% agreed). Roughly 42–52% strongly agreed that technology increased the development of new concepts (only 6% were neutral on this item). Finally, 40.5–54% felt positive to very positive that technology helped children learn important concepts and ideas.

3.6 Phase two: key findings

The results of phase two revealed two themes. This section is therefore divided into two sections. The first discusses participant readiness to use technology in terms of technical and pedagogical skills, while the second discusses factors that may affect technology integration.

3.7 Transitioning from readiness to practice

Participants were asked about how they implemented technical and pedagogical training regarding technology into professional practice. Results indicated that all 11 phase-two participants believed they were able to transfer their technical skills in this regard. For example, Participant 2 said “I have the skills to work with PowerPoint, other programs, and online resources such as online gamified learning platforms,” while Participant 7 said “I can integrate technology into my lessons.” Participant 8 affirmed, “Yes, I can use technology in the classroom. I use videos [and] PowerPoint.” Indeed, 7 out of the 11 total participants elaborated on their ability to create digital learning resources and use them as teaching tools. For example, Participant 5 said “I use technology as an educational method, so I must prepare for it. I use some programs that I learned in college and create digital resources in a very attractive way. I can use them in class activity corners and when explaining lessons.” Participant 7 also discussed their ability to create digital resources, saying “I use technology as a teaching method and [even] created a video using pictures. In one of the courses I took in college, I learned how to create a platform that includes pictures about the growth stages of plants.” Participant 9 responded “Yes, I use technology. I used a program to create pictures about different types of fruits. I used it with children here in the classroom.” Participant 10 also commented on this, stating “I can use some programs. Once, I created a lesson using programs I learned in college,” and Participant 11 said “I created a short video that lasted roughly 5 minutes. The children asked me to replay it multiple times, which means they liked it.”

In terms of transferring pedagogical readiness into action, results showed that participants believed technology could help students understand new concepts. For example, Participant 1 stated "I projected digital storytelling on the whiteboard. When it was finished, I asked the children some questions regarding the new topic, and they answered them correctly." Participant 2 explained that technology also assisted in their teaching of new concepts: "I have difficulty orally explaining the concept of oil. I presented a short video about the concept of oil on the whiteboard, and this helped the children understand the concept easily." Participant 3 added "I agree with the use of technology in the kindergarten classroom, so that a child [who is] five to six years old can learn from it easily. So, using technology affects my way of teaching. It makes lessons easy, especially [for] some of the concepts that I can explain orally. I can use videos or any useful software." Participant 5 said "The use of technology is great because we are in the age of technology, so all the children are more excited if something is presented to them on a large screen [like] 'the whiteboard,' These pictures or videos help them understand new topics." Participant 7 said "Today, I projected some pictures and a short video on the smartboard, and this helped the children understand the new concept," and Participant 8 said "I agree that children can understand better with technology. Once, one boy brought his iPad into the classroom. His mum had downloaded an educational game that teaches letters and numbers; it was an amazing lesson for all the children. They now know the pronunciation of the letters and numbers." Participants also stated that technology could be used to reinforce and motivate children, especially by using software that includes a "clap noise" when they answer correctly or a "sad face" when the answer is incorrect. For example, Participant 5 said "Using technology is very wonderful for reinforcement and motivation. I tried it with children; whether it was applause, the appearance of a star that is presented on the whiteboard, or a recording of a voice of one of the children saying 'you did well' enthused the children." Participant 8 also remarked on this, saying "I use the PowerPoint program that contains applauding sounds for the correct answer, [but tells them] to try again if the answer is wrong."

Interview results also revealed that only two participants used technology to encourage teamwork. Participant 3 said "I use software; this encourages children to work in groups. They collaborate and share ideas," while Participant 4 said "I used digital games in the classroom, and this encourages children to work together." Only one participant (Participant 11) stated that they used technology to communicate with parents: "I used Moodle to communicate with parents instead of using papers or emailing them. I can send videos for children to learn and [give them] some homework to do."

3.8 Factors affecting technology integration

Participants also reported challenges they had faced during their professional teaching practice. The primary barriers to technology use were the number of students in a classroom and school infrastructure. For example, Participant 1 said "There is a huge number of children. I need computer labs and active learning rooms. It is difficult to ask children to bring their own devices," while Participant 6 said "There is a huge number of children. It would be much better if there were only 10 to 15 children in

the class." Participant 2 also commented on the availability of Internet connection, saying "Internet unavailability is the main problem facing us, and another problem is that we need a few more programs." Participant 4 said "[There is a] lack of equipment [and] a large number of children. [These] are the main problems facing me. We have ideas for using technology in the classroom, but the school environment is not helping us." Participant 6 remarked that "Sometimes, the computers shut down suddenly, or the projector does not work well. And Participant 7 said "[the] hardware needs maintenance." Participant 8 detailed the challenges they faced: "The difficulties I face are capabilities, class size, class environment, and the number of children." Participant 9 said "I face a number of challenges when using technology in the classroom, such as the huge number of children in the room. Also, the classroom environment. The school has no computer lab or even computers, so I usually bring mine." Finally, Participant 10 said "[There is] poor infrastructure, no financial support, and no equipment available; these are the main difficulties."

Participant 9 mentioned other factors that negatively impacted technology integration, including the school administration and student families, saying "[There are] administrative barriers and laws that prevent us from using technology. Likewise, parents are afraid of us using technology. They believe that technology is a bad thing, so they prohibit their children from using it. Also, they do not support us in using it." Participant 11 added "I use Moodle, but parents do not help us by communicating."

Some participants also provided some suggestions that could help them integrate technology. Participant 9 said "parents and the community [should be provided] with training courses on using technology," while Participant 10 said "[We should] encourage children to use their devices for learning, not just playing."

Results also showed that participants believed their college courses had provided them with support, specifically those that taught them how to use software and applications. However, these courses did not focus on classroom technology integration in the kindergarten setting in order to support communication, teamwork and connect with parents. Participant 7 said "I learned about technology in more than one course, and I can create and edit videos. This is easy for me, but I faced difficulty when I practiced it here in the classroom because I did not practice it in college," while Participant 11 said "I have skills in many software [applications] that we were taught in college, so I want college course activities to not only focus on teaching software or applications, but to also teach how to integrate technology in the kindergarten classroom to create teamwork and connect with parents."

Others said that college courses focused on teaching software and programs that are not relevant for young learners. For example, Participant 11 said "I don't know certain things, even though I have a good level of technical skills for the programs that they taught us in college, [which] are useful for schools, but not for children in kindergarten. So, we need to learn these programs or software [applications] that are appropriate for children, and not for [those of] the older school age." The same participant also said "Colleges can hold workshops for us. Even if we are engaged in practical work, we can attend them and learn how to use technology and design lessons for children." Further, Participant 10 said "The courses we were taught in college were with students from other majors who would become intermediate and/or secondary school teachers. So, much of the software we learned was appropriate

for older [students], but was not suitable for children." This participant also said "I suggest separating us in these courses from the other majors, so we can benefit from materials and software that we learn, and also allow us to use computer labs, which are currently for the computer department."

4 Discussion

This mixed-methods study employed a sequential model to explore Saudi kindergarten student-teachers' readiness to integrate technology into their future classrooms and the factors that affect their integration. Readiness was measured based on two dimensions, including technical and pedagogical readiness. Pedagogical attitudes and opinions toward technology integration were also explored.

General findings indicated that all participants had the technical skills needed for technology integration. They could use technological communication tools (e.g., e-mail and social media), create presentations (e.g., using blogs, Wikis, and educational websites), implement learning management systems, and design online quizzes. This finding supports previous studies (Bate, 2010) that found that new teachers who spent their childhood years surrounded by technology typically develop related technical skill sets. These teachers are therefore more open to the idea of integrating technology into the teaching practice (Goe et al., 2011) and are typically proficient with technological skills (Whetstone & Carr-Chellman, 2001; Iding et al., 2002; Doering et al., 2008).

Furthermore, self-reported survey data also indicated that all participants have a good grasp of the basic principles for pedagogical readiness to integrate technology in learning and teaching processes. The results of the interviews show that the participants were able to transfer their technical skills into professional practice. They were able to create digital learning resources using videos, pictures, and applications. This finding support the results from the study by Sadaf et al. (2016) and Alkhayat et al. (2020) that found that student-teachers were ready to translate their use of Web 2.0 tools into professional practice in order to improve learners' learning. However, the results of the current study found that only a few student-teachers were able to use their pedagogical competency to use technology to facilitate teamwork and communicate with parents. This supports previous studies findings that limited numbers of student-teachers were able to use technology to facilitate student-centered learning (Koc &Bakir, 2010; Tondeur et al., 2017). Previous studies have shown that student-teachers feel that they cannot adequately integrate technology into teaching and learning processes (Instefjord, & Munthe, 2017). In relation to this, some of the current study's participants recognized the lack of teacher preparation programs to support pedagogical practice. This aligns with the findings of Ranieri & Bruni (2018), who stated that teacher preparation programs focus on the use of technical skills, not on pedagogical competency. Koc and Bakir (2010) concluded that teacher preparation programs should provide student-teachers with environments that support learner-centered, collaborative, authentic and inquiry-based learning in order to help them understand how to use technologies as tools to enhance their teaching and students` learning. Tondeur et al. (2017) suggested that teacher preparation programs

should establish a "link between technology, pedagogy and content knowledge in all aspects of their education and fieldwork."

The participants in this study believed that technology enhanced student-centered learning, communication, and collaboration, and generally supported learning for children. They held positive pedagogical attitudes toward technology integration in the kindergarten setting. However, phase two identified three factors that influenced technology integration, including the school environment (e.g., infrastructure, administration, and student numbers), parental beliefs, and the difficulty of transitioning skills from a teacher training program into practice. These findings align with previous research which found that some student-teachers are unable to transfer technology into practice due to limited access in the school setting (Sadaf et al., 2016) and problems with school infrastructure (Bate, 2010).

The participants in this study also said there was a lack of advice on how to integrate technology into practice. Previous studies suggested that peer feedback has the potential to support the development of student-teachers' pedagogical competencies (Røkenes & Krumsvik, 2016; Tondeur et al., 2018). This feedback should continue during their practicum training (Tondeur et al., 2012, 2018). It was also suggested that student-teachers should be provided with opportunities to design digital activities (Tondeur et al., 2012) and share their experiences regarding how technology can be used in practice (Røkenes & Krumsvik, 2016). Other studies suggest that student-teachers should be provided with training on how to support technology integration in their pedagogical approaches (Reisoğlu & Çebi, 2020). Reisoğlu and Çebi (2020) further stated that training could improve student-teachers' digital competences and support them to utilize these competencies in their professional practice. Luo et al. (2020) concluded that while teacher preparation programs have the potential to provide high quality training in technology integration, they should also improve the cooperation of current teachers and faculty members to serve as exemplars for technology integration.

Finally, a few participants in this study reported that the courses in the college taught them to use educational software and applications that are not appropriate for young children. This was also confirmed by Alkhayat et al. (2020) who found that some of Web 2.0 technologies used in teacher preparation programs (e.g., Skype, Wiki, and blogs) are not appropriate for small children.

5 Limitations

This study was limited by its small sample size. Additionally, participants were recruited from only one college in the eastern area of Saudi Arabia. As such, generalizability is limited to student-teachers who are in similar courses at other universities or colleges. In addition, while this study collected self-reported data during follow-up interviews, observational data could have provided valuable insights (Bryman, 2004, p. 33). However, the researchers were unable to conduct classroom observations due to time constraints caused by COVID-19.

6 Conclusions

This study suggests that teacher preparation programs have an important impact on student-teachers who are attempting to integrate technology into teaching practice. The current study's results highlight the urgent need to re-orient teacher preparation programs to focus on technology use in pedagogical practice and enable student-teachers to foster student-centered approaches. In this regard, effort should be made to redevelop teacher preparation programs in order to help teachers effectively use technology in this way (Tondeur et al., 2014, in Farjon et al., 2019). International organizations have called for 21st century teachers to adapt technology training to focus on the 4 Cs of communication, critical thinking and problem solving, collaboration, and creativity (Alkhayat et al., 2020). This study further identified factors that could affect technology integration and suggests that schools should provide necessary resources to support technology integration. Furthermore, governments should increase families' awareness about the importance of technology integration at the kindergarten level.

Disclosure

Conflicts of Interest None.

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