Journal of Positive School Psychology http://journalppw.com
2022, Vol. 6, No. 5, 2387 – 2401

Saudi Teachers' Perspectives of the Impact of Using Technology in Gifted and Talented Classrooms

[1]Abdullah Hamoud Abdullah Alshehri

[1]Assistant Professor of Gifted and Creative Education, Department of Special Education, Najran University, Email: ahalshehri@nu.edu.sa

Abstract

It generally agreed that technology skills are a necessity for education and career success. However technology is always evolving and so the development of students' skills in technology use is an ongoing endeavor. Partnership for 21st Century Skills and the International Society for Technology in Education standards urge teachers to assist students to develop skills to adapt to changing workplace environments. Such skills are reflected in the standards for teacher preparation embedded in the National Association for Gifted Children program. Previous descriptive research has been conducted on what is taking place in classrooms, but the findings are often limited to a set or compilation of activities. This multi-case phenomenological study applying qualitative research paradigms was conducted on seven teachers (from Asir in south Saudi Arabia) of gifted students to investigate how used technologies with the students and fostered the development of 21st century skills. Teachers were selected for this case study based on their reputations as skilled technology users with students, particularly during COVID19 pandemic. Data were collected via teachers' lesson plans, semi-structured interviews, and researcher observations. A thematic analysis of the data was then conducted. This study found that teachers' uses of technologies for learning with gifted students is influenced by several factors including teacher attitude towards technology use, level of expertise, and access to resources and support. Also of influence were pedagogical decision making in relation to technology applications, and the characteristics of the student group using the technology.

Keywords: technology for learning, gifted students, teacher attitude, elementary education.

INTRODUCTION

The attitude of the teacher towards technology use and their willingness to engage with new programs and applications make a difference to the learning outcomes of gifted and talented students (Carver, 2016; Li et al., 2019). Teachers must therefore be encouraged to use new devices and software programs as part of their teaching pedagogy and be supported to prepare meaningful technology-based learning for students (Kafyulilo, Fisser, & Voogt, 2016). Moreover, teachers are under increasing pressure to develop their knowledge of how to use technologies for learning as well as to develop their skills at implementing the technologies with students to achieve learning outcomes. Such knowledge and skills acquisition must be ongoing, practical, and differentiated to meet the varying needs of teachers (Li et al., 2019). The establishment of professional learning communities can facilitate this outcome whereby teachers of different years levels and across school districts are provided with opportunities to share their ideas and experiences in implementing technology with gifted and talented in the classroom in both face-to-face and online forums (Battersby & Verdi, 2015). Teachers will then have opportunities to build their knowledge and understanding of current best-practice technology utilization in the classroom and how to plan meaningful technology-based learning opportunities with students.

Research question

A technology-rich learning setting is typically characterized by regular, purposeful, and meaningful applications of technology by the teacher to promote student learning (Groff, 2013). As such, the 'richness' of the technology-based learning setting is largely dependent on how the teacher engages in technology use rather than the amount and types of the technologies available. As a result, this study sought to answer the research question:

In what ways do the utilizations of technology by the teacher with gifted and talented students shape the students' experiences of technology?

Methodology

Technologies for learning can be utilized in a multitude of ways making it difficult to account for all possible applications using a closed survey (Bebell et al., 2010; Clark et al., 2009; Domingo & Garganté, 2016; Park et al., 2019). Moreover, the purpose of utilizing technologies for learning is not always made evident in general research (Lagrange & Erdogan, 2009). Closed-question surveys, or even Likert-scales to indicate frequency and so forth, cannot adequately measure the quality of the technology use (Domingo & Garganté, 2016). Hence, alternative research methods are required. This study sought rich descriptions of teachers' perspectives of how they incorporated technologies for learning into the classroom when teaching gifted and talented students. Using a qualitative phenomenological multi-case study design (Creswell & Poth, 2016), the aim was to generate descriptions and explanations of teachers' perceptions Of their technology use rather than on the students learning outcomes of technology use (Merriam, 2004). That is, to describe and explain teacher's utilization in the classroom.

Participants

The selection of participants in phenomenological case study research has the aim to deliver a representative sample of the broader study population (Flick, 2018). This study selected teachers with a Master's level qualification to teach gifted and talented students. Participant selection was facilitated using the Department of Gifted Care database in the General Administration of Education in Asir. All teachers had completed a survey to get their views on the importance of developing 21st century skills with students, and the extent to which they believed they were effective in teaching these skills to students. The survey results were used to identify teachers who utilized technology in the classroom frequently and who had similar perspectives and attitudes to ensure sample homogeneity (Flick, 2018). Seven teachers were selected for participation in this study. Table 1 presents the demographic profile of the Saudi teacher participants and brief details of the schools where they taught:

Table 1. *Demographic profile of Saudi teacher participants*

Participant ID.	Years teaching G&T students	Location of school	Size of school	Technologies at school
T1	5	Suburban	>150 K-6 students	Laptop, technology lab. and equipment, 2 iPads, Smartboard
T2	6	Suburban	>120 K-6 students	Desktop computers, netbooks, projector
T3	4	Suburban	>170 K-6 students	Smartboard, desktop computers, netbooks

T4	3	Suburban	>200 students K-6	Projector, some new some old desktop computers,, digital cameras
T5	5	Suburban	>250 students K-6	Desktop computers, projector
T6	7	Suburban	>180 students K-5	Laptops , some desktop computers, projector
T7	3	Suburban	>200 students K-6	Smartboard, desktop computers

Data collection

The collection of data was throughout January and February 2022. Three data sets were collected for analysis and triangulation: teacher lesson plans, teacher interview responses, and researcher observation notes (two observations per teacher). Table 2 provides a summary of each data source, the predicted codes for each source, and the reason for predicting the codes.

An interview protocol with questions and potential follow-up questions was utilized. Drawing from relevant literature (e.g., Bielefeldt, 2012; Creswell & Poth, 2016; Flick, 2018), a list of survey items was formulated regarding technology use in the classroom. The items were formulated with consideration of the International society for technology in education (ISTE, 2021), and Partnership for 21st Century Skills [P21], 2009).

Table 2 *Data plan*

Data set	Predicted coding	Related citations
Lesson Plan (Creswell & Poth, 2016)	Resources Student engagement / reflection Accuracy Purpose Connection to learning topic / students' real-world experiences Self-directed / teacher-directed learning	(Periathiruvadi & Rinn, 2012); Siegel, 2005; Zembal-Saul, 2009)
Interview (Creswell & Poth, 2016; Flick, 2018; ISTE 2021; P21 2009)	Instruction and assessment Technology support Available technology Attitude / teaching philosophy	(Periathiruvadi & Rinn, 2012; Zembal-Saul, 2009)
Observation (Bielefeldt, 2012; Creswell & Poth, 2016)	Innovation Resources Student engagement Connection to learning topic / students' real-world experiences Self-directed / teacher-directed learning	(Periathiruvadi & Rinn, 2012; Zembal-Saul, 2009)

Questions regarding the relationship between student-centered teaching and technology use, and those targeting teachers' attitudes towards technologies for learning sought to facilitate deeper understanding of the research topic (Creswell & Poth, 2016). The interview protocol was used to guide rather than prescribe the interview process (Flick, 2018). With the participants' consent, all interviews were audio-recorded and transcribed for analysis (Creswell & Poth, 2016; Flick, 2018). An observation protocol adapted from Zimlich (2012) was used to facilitate descriptive note-taking during the researcher's observations of participants (Marshall & Rossman, 2016).

Data analysis

Reflecting traditional qualitative research methodology, a thematic analysis of the teachers' lesson plans, interview responses (transcripts), and researcher observation notes was performed. Coding of the three data sets to identify their salient themes was accomplished iteratively. This supported identification of the frequency of each theme during initial coding. The process of analysis and reanalysis (i.e., multiple reviews of each data set) was performed until the identification of a cohesive set of codes (Creswell & Poth, 2016; Flick, 2018).

This study applied an emerging research design via the concurrent approach to the collection and analysis of data. That is, a computer spreadsheet was utilized to segment data units as they were collected, arranged and manipulated (Creswell & Poth, 2016). Both within-case and cross-case thematic coding were performed, with the identified themes emerging from the similarities and differences apparent in the teaching settings (Siegle, 2005) and participants' characteristics (Creswell & Poth, 2016).

Insights into the different conceptions of teachers regarding the meaning and use of technologies for learning was facilitated by cross-case analysis (Siegle, 2005). Codes were generated by the researcher related to general categories, frequency counts, and illustrative examples (Siegle, 2005). Forming these generalizations was aided by data manipulation using spreadsheet software. The main ideas and interpretations and salient themes to emerge from the analysis were then recorded by the researcher (Creswell & Poth, 2016).

Direct interpretation of codes and their categorical aggregation could both be applied to the three data sets. The objective was to create rich descriptions rather than to generate generalizable findings; however, there did emerge from the data sets thematic patterns and natural generalizations (Creswell & Poth, 2016; Flick, 2018).

Member checking

Following completion of the data analysis, member checking was undertaken whereby the participants were asked to verify the accuracy of the interpretations. Via email, the participants provided feedback on the logic of the coding applied and the accuracy of the themes generated from the analysis.

Triangulation

Triangulation was then performed on the analysis outcomes of the teachers' lesson plans, interviews responses, and researcher observation notes to identify corroborating evidence regarding the teachers' perspectives of the use of technology in gifted and talented classrooms (Johnson & Christensen, 2019). The coding of data and generation of themes continued as the research progressed. The reliability of this study was also enhanced through the generation of detailed field notes and record-keeping of all decision regarding the coding process and categorization of themes (Johnson & Christensen, 2019).

Of interest to this study were the curriculum underpinning the utilization of technology with students in the classroom, the level of learning autonomy afforded the students during classes, the presence of differentiated teaching for gifted and talented students, and the uses of technology to facilitate differentiation. In addition, focus was given to themes associated with the 21st century skills framework including creativity, digital literacy, collaborative learning, career skills, and communication (P21, 2009). Other significant themes were also revealed upon ongoing data collection and analysis. Analysis of the data was performed at the classification and typology levels right up to an investigation of the complexities and challenges associated with technology use in the classroom. Lastly, assertions based on interpretations of the data were made regarding the level of learning autonomy afforded the gifted and talented students and the technology-driven differentiation methods utilized by the teachers. Also, whether the aim to develop students' 21st century skills was the main driver of technology use in the classroom.

Results

The gifted and talented teacher participants were found to share commonalities in relation to teaching philosophy, attitudes towards the use of technology in the classroom, and the type of climate they sought to create in the classroom. Several teacher-related factors were found to shape the way the gifted and talented students interacted with the chosen technology including the classroom climate established in the teacher, the nature of the teacher-student relationships, and the teacher's general attitude towards and level of expertise in the use of technologies for learning. Table 3 presents examples of the commonalities among the participating gifted and talented Saudi teacher participants in this study:

Table 3. *Teacher profile and practices*

Coding	Definition	Example
Classroom climate	Layout and atmosphere of the gifted and talented classroom	Arrangement of computers to assist multiple students simultaneously Comfortable learning environment for students Student autonomy
Bond	Trust and support in the teacher-student relation	Teacher has good awareness of students' abilities Teacher can demonstrate good content knowledge Teacher develops relationships with the students over 1-3 years Students teacher with technical support i
Attitude	Disposition displayed by the teacher	Teacher demonstrates cultural awareness and curiosity Teacher is proactive to seek new learning experiences and try new technologies
		Teacher engages the support of technology experts
Opportunity	Recognizes diverse conditions for learning	Previous technology experiences inform future technology-based teaching practices Lesson plans are flexible to respond to potential issues or necessary adjustments
Know-how	Ability to use technology for teaching Awareness of technical issues	Teacher uses technology for personal and professional outcomes Teacher plans meaningful technology-based learning experiences with students Teacher can identify and respond to some technical issues when utilizing technologies for learning with students
Motivation	Willingness to utilize different technologies Strategies for technology use	Professional development workshops that promote new technology uses Teacher supports colleagues to improve uses of technologies Teacher seeks out ways to utilize technology to improve teaching practices

Equipment

Equipment refers to both the technology hardware and software utilized in the gifted and talented learning settings. The type of equipment available to the participating teachers was influential in shaping the learning activities implemented in the classroom. Table 4 presents examples of the factors to influence the type of equipment available to the gifted and talented teachers and how it influenced their use:

Table 4. *Technology*

Coding	Definition	Example
Funding limitations	Funding decisions at the school and district levels impact the technologies and time available to teachers	Preparing and implementing uses of available technology hardware, software, and Internet sites within the funding constraints
Technology assets	Available technologies determined the teacher's preparation and lesson designs	Utilization of available technologies Requests for additional technologies and funding
Quality of technology	Availability of recently developed technology software and hardware for use by teachers and students	Outdated technologies led to frustration and disengagement at times New technologies include functions to support multiple learning pathways
Distribution	How technologies for learning are 'distributed' throughout the school	Some functioning technology available in gifted and talented classrooms Availability of school-wide technology dependent on bookings and usage rates Technology not always available for gifted and talented students

Pedagogy

Pedagogy relates to the choices by teachers that shape the students' learning experiences. In terms of the teachers' pedagogical choices around the uses of technology in the classroom, they related to the planned or spontaneous nature of the lesson and such features as flexibility in the structure of the learning activities and the level students learning autonomy. They also relate to the extent to which teacher scaffolding was used, the ways in which the technologies for learning were integrated with the learning content, how the instructional tasks were sequenced, and the planning around providing the gifted and talented student with hands-on technology-centered activities. Tables 5A-5C present the pedagogical choices around technology use by the teachers in this study.

Table 5. *Pedagogy: Technology-based learning activities*

Coding	Definition	Example
Pace	Controlling the amount of time allocated to the sequenced learning activities Pace control mechanisms include verbal instruction, provision of worksheets, and preparation of technologies for use	Students allocated time to use the technologies with limited direct instruction. Students self-direct their exploration of the technology features Learning activities may span
Practical hands-on uses	Students engage with and utilize the technologies	Students allocated time to explore the features of the technology before attempting the learning activities, Students practice using the technology independently and in groups with scaffolding support provided to students experiencing difficulties

Table 5. *Pedagogy: Technology-centered teaching*

Coding	Definition	Example
Mentor	Students are supported via connections with expert others	Online platforms used to access expert others from multiple locations to provide advice and feedback to students
Flexible Personal	Students provided with choices to promote learning autonomy and preferred learning styles	Differentiated teaching implemented to accommodate different skill levels Students make decisions about learning topics based on their interests and preferences Students engage in both independent and group-based work supported by the provision of necessary resources
Respond	Teacher designs learning activities and skills development based on students' needs	Impromptu or unscheduled individual or group-based activities implemented in response to student requests / needs
Scaffold	Teacher models technology use to improve students' understanding of features and processes	Assessments of students' readiness to use technology Iterative technology skills development approach implemented over several years building on technology skills and content taught

Table 5. *Pedagogy: Technology-centered teaching content*

Coding	Definition	Example
Integrate	Extent that uses of technologies for learning is embedded into the learning activities	Technology use and skills development taught explicitly using direct instruction
Plan	Deliberate organization of technology-based learning activities	Sequenced learning activities: Technology use was first aligned with learning topic Use of new technologies was modelled for students who then worked individually to complete task and resolve issues Verbal instructions provided to initiate student work
Complexity	Learning activities using technology move along a continuum from explicit instruction to implied instruction	Collaborative learning dynamics where students support each other to use the technology effectively
Critical thought	Learning activities requiring higher-order thinking such as problem solving, creative expression, critical analysis, and evaluation.	Technologies employed as a tool for critical thinking and creative response-making related to the lesson content and instruction

Discussion

The technology experiences of gifted and talented students were shaped by the teachers' pedagogical decision making around the technology utilized in the classroom in relation to the characteristics of the students and the teacher. The students' classroom experiences taught them that technologies for learning

should be explored, can facilitate independent learning, and that they can be integrated into all aspects of life, notwithstanding that this call for persistence on their part at times. Teachers drew attention to the role of technology in the future careers of the students and that technological devices or equipment were in a constant state of development and improvement. Teachers drew a distinction between informal (recreational) and formal (educational) uses of technology, by requiring the students to use the technologies to produce both structured and creative work products.

Pedagogy

Teachers developed their expertise in using technologies for learning in line with the frequency in which they utilized technology and the consistency with which they provided the students with technology-based learning experiences (Glassman & Burbidge, 2014). This developing expertise provide the teachers with new insights into the ways to embed technology use into lesson planning and the sequencing of learning activities. As Clausen (2007) explains, as teachers gain more experience in the uses of technologies for learning they become better at blending technology into their teaching practice and the students' learning tasks. By gaining experience in technology use, the Saudi teacher participants developed better awareness of the different types of technology-based learning activities available to the gifted and talented students in different learning situations including the completion of research, organizing their work products or exploring topic of interest (Clark et al., 2009).

Gaining experience in using technologies for learning also led the Saudi teachers to develop a better understanding when to provide specific instruction to gifted and talented students about the processes required to accomplish the learning task using the technologies. The Saudi teacher participants developed their awareness of when to provide support to students and when to allow them to resolve any challenges with using the technology on their own. The teachers also used the new knowledge they gained about the challenges students may encounter when using technologies for learning to embed prevention strategies into their lesson plans. The Saudi teacher participants also encourage the gifted and talented students to reflect on their experiences of using other technologies when encountering a new technology in the classroom. As such, students were encouraged to approach technology use in the classroom with a sense of curiosity.

The Saudi teachers' personal approaches to using technology in general were also reflected in their attitudes towards the use of technologies for learning and how they planned the students' learning experiences. The teachers utilized the technologies in the classroom to promote student learning independence, a concept and skill which has often been investigated in previous studies. The Saudi teacher participants' attitudes towards technology use in this way contrasts to the P21 Framework (2009) and its promotion of the development of students collaborative learning skills. Data included examples of collaborative learning by students and they had access to other students with like interests or to experts online, however it was evident that promotion of the independent use of technology by the students was the objective of the teacher. On occasion the teacher had the students complete the learning activities in pairs or in small groups, but it was often the case that the students worked with a partner as a result of there being limited hardware available or due to time constraints. On the occasion when the teacher purposefully design activities for students to work with a partner it was generally the case to allow one student to provide support a peer to either use the technology or to be a role model in how to explore the technology. Support from the teacher was provided when required and the students were urged to resolve any issues and work out the functions and features of the technologies independently. Hence, the Saudi teacher participants assigned greater emphasis to students working independently than on them developing collaborative learning skills.

Student learning experiences

Several factors to influence the ways in which the Saudi teacher participants shaped the students' learning experiences emerged from the students. Previous research has shown that the availability of technology in the home of a student can influence how teachers prepare and implement learning activities in the classroom (Neumann, Finger, & Neumann, 2017; Siegle, 2005). Teachers develop the technology-literacy of gifted and talented students incrementally, sometimes over several years. Teachers in this study typically prepared and modeled technology-based learning experiences to promote students' uses of technology as a learning resources and tool. They allocated time for the students to share their work using technology and the technologies for learning were often integrated into the learning activities across multiple subjects, at times in quite complex ways, in order for the students engaged with the learning content the uses of technology simultaneously. The teachers themselves also utilized the technologies in order to promote and demonstrate the functional aspects of technology use across multiple subject area. Moreover,, the teachers endorsed the responsible use of technology with their students.

A key finding reported in this study that has not been reported in previous studies is related to the trust between teachers and gifted and talented students and its impact on the technology-use experience. The level of trust between the teacher and students influences the nature of the learning activities a teacher can implement with students. Trust in this context can affect how cooperative students are, how safe they feel in the learning environment, and how engaged they are in the learning activity (Brookfield, 2015; Pinhasi-Vittorio & Ben-Yosef, 2014). In general, the teachers participating in this study built trust with their gifted and talented students by designing flexible and open the learning activities. This then influenced the design of the technology-based learning activities the teachers prepared for the gifted and talented students.

Students' technology-literacy was further developed as a result of both smaller class sizes combined with the provision of multiple opportunities to the students to utilize a range of different technologies. The teachers had taught the gifted and talented students over several years which allowed them to purposefully design and sequence lessons involving students' uses of technology in a way that developed their technology skills in an incremental way. Nonetheless, due to time constraints; namely, the amount of time the teacher taught the students over a week, the focus was placed on supporting the students to develop their knowledge and skills at managing learning goals and completing learning tasks. Teachers endorsed technology as a useful tool for learning which could be mastered over time with effort and persistence. This encouraged the gifted and talented students to engage in independent work practices and provided some albeit limited opportunities for self-directed learning.

The technology-based learning activities help students to develop the skills included in the P21 Framework (2009) such as researching and utilizing information, managing multimedia texts, and using technology to explore personal interests. Teachers also adopted a long-term perspective of the development of these skills through the consistent provision of hands-on technology use experiences to students to develop a range of skills likely required for their future careers. As a result, the level of trust and support apparent in the gifted and talented classroom facilitated development of the technology literacy skills. The learning activities prepared and implemented by the teacher also supported achievement of the life and career outcomes embedded in the P21 Framework (2009) via the opportunities afforded the gifted and talented students to critically reflect on the role of technology use in their understanding of the learning content.

Professionalism

Not all factors to influence the utilization of technologies for learning emerged from deliberate decision making by the teachers. Indeed, the broader teaching context and

conditions also had an influence. Previous studies have reported that decisions made by school administrators or at the school district level can affect the nature of the lesson activities prepared by teachers for their students (Clausen, Britten, & Ring, 2008; Nikolopoulou, 2020; Wade, Rasmussen, & Fox-Turnbull, 2013). For instance , decisions made at these levels may impact the availability of technology resources or provide controls around what technologies the teachers are permitted to use with students (Chai, Koh, & Tsai, 2013).

In the present study, the participating teacher often did not a have access to recently-developed technologies or to the types of technologies they would have liked to use. How technology was distributed within the school impacted on the extent to which students could be provided with hands-on technology-use experiences and how the teachers planned the technology-based lessons. The policies implemented at the school and district levels, included the blocking of particular websites and the accessibility of computer labs or devices placed limits around teachers' lesson preparations . The availability of technologies for learning determined at times the ways by which the gifted and talented students could accomplish the learning activities. Notwithstanding these limitations, the participating teachers did what they could to access technologies for the students to use for learning in creative and diverse ways.

The general attitude of the teachers as revealed during interview was to play around with the technologies and to identify new tools, which formed the basis of what they encouraged their students to do. However, the teachers also referred to activities such as the use of QR code applications that they were interested in implementing in the classrooms but did not have the opportunity to do so. Indeed, some participants mentioned that they were pro-active in their effort to acquire funding to update the available technologies. This impacted their teaching in that they could only utilize the technologies and their function to which they had access.

Students will inevitably run into problems when engaging in hands-on technology-based learning experiences. Similar to previous research (e.g., Henriksen, Mehta, & Rosenberg, 2019; Garcia & Rose, 2007; Ozcan & Bicen, 2016), this study has shown that teachers are more likely to utilized technologies they feel comfortable using (. Previous research has also reported supporting teachers who are novice users of educational technology is crucial (Clausen, 2007). This study suggests, however, that the provision of technology support to teachers with experience in utilizing technologies for learning is equally crucial. The Saudi teacher participants in this study may have had some expertise in the use of some types of technology, yet they nonetheless still sought technology support when they were using some technologies or software programs for the first time. Other research has also found that a teacher's long-term use of technology, both inside and outside of the classroom influences how they use technologies for learning with students (Clausen et al., 2008; Henriksen et al., 2019; Garcia & Rose, 2007; McKnight et al., 2016; Ozcan & Bicen, 2016).

Teachers are pro-active in seeking training support to assist them better plan how to better integrate the technology in the learning activities. The research evidence shows that such training also influences how teachers utilize technologies for learning (Clausen et al., 2008; Henriksen et al., 2019; Garcia & Rose, 2007; Lennex, 2014; Voogt et al., 2013). Similar to Garcia and Rose (2007) who reported that pre-service teachers often conceptualized the ways in which they would utilize the technology in the classroom, the teachers in this study also conceptualized how they would integrate new technology into their lesson plans. Some researchers (e.g., Clausen et al., 2008; Lennex, 2014) have also claimed that teachers require time to collaborate with colleagues to determine how best to integrate technologies for learning in the classroom. What this research shows however is that some teachers currently use technological platforms including email and/or professional networking sites to collaborate with colleagues who have an interest in developing their knowledge and

skills in using technology for learning. As a result, these teachers beyond the school setting to create a type of professional learning community utilized technology.

Practice Implications

The practice implications to emerge from the findings of this study include the need for targeted strategies to be utilized by school leaders and district administrators to encourage teachers to be pro-active in their use technologies for learning with students. It remains the case that school administrators have the greatest influence over the types of technologies available to teachers for use in the classroom. However, this study has confirmed the view that it is the quality of the technology available rather than its quantity that determines teachers' decisions around whether or not to uses technologies for learning with students.

Pedagogy

Two salient themes to emerge from the data set in this study were related to technology assets and technological support. These represent two domains over which teachers typically have limited influence given they are primarily controlled by decision making at the school leadership or district administration levels. In turn, when deciding on the types of technologies to purchase , school leaders or district administrations can assess the extent to which new technologies are being fairly distributed. This study revealed that lack of access to technology labs in the school limited the technology-based teaching and learning options available to teachers. School leaders should audit the extent to which teachers in the school have equal access to educational technologies, as well as the types of technology-based learning activities the teachers are implementing in their classrooms.

Unquestionably, the policies and protocols in schools and across the school districts regarding what technologies can be utilized (i.e., what websites are blocked from use), influence the types of technology-based learning activities that teachers can implement with students. Districts administrators should therefore ensure they have a plan in place for implementing changes to the accessibility of online resources as effective learning programs are developed around their use. For example, it is currently the case that some district administrators do not permit teachers to utilize social media platforms. However, a teacher participant in this study taught at a school where Edmodo was utilized for the provision of technical support to teachers in classrooms and among all schools in the district. In addition, establishing a panel of teachers to assess the educational value of different online sites and resources will support more informed decision making around which websites to block.

Some Saudi teacher participants in the present study utilized a range of technological applications including Microsoft Teams from home to plan learning opportunities for gifted and talented students. The students would then log onto and utilize the Madrasti platform and Microsoft Teams in the classroom as well as when they were at home. A student attending one school who did not have access to a computer at home was permitted to use the computer at school before school hours to complete online learning tasks. Furthermore, WhatsApp was utilized by one teacher participant in this current study to communicate with the parents about their child's learning progress. This teacher would not have had this opportunity to support student learning had the site been blocked by the district administrator.

A distinction can be made between teachers' uses of technology to instruct and students' uses of technology to learn. The technological expertise of the teacher participants in this study developed in part as a result of the extent to which they integrated technology use into the students' learning activities. For instance, teachers with a clear learning objective for students who has good content knowledge and is familiar with how to present learning material using suitable technologies (e.g., Smartboards or PowerPoint presentations) can provide students with additional time to engage with educational technologies in authentic ways. This points to the importance of integrating technology-based learning projects with other learning content which allow

students to utilize the technology to investigate and experiment while learning. Based on this, evaluations of teachers' uses of technology by administrators can focus on the implementation of long-term and authentic technology-based learning projects rather than a single classroom observation.

Knowledge of the learner

This study reported that the Saudi gifted and talented students also helped to shape the types of technology utilized in the classroom. The Saudi teacher participants in this study were fortunate to have the same group of students over several years. These teachers were therefore afforded the opportunity to plan for and sequence students' uses of technology in the classroom across multiple years to develop their technology use proficiency. This study acknowledges that many teachers do not teach the same students group for several consecutive years. These teachers can, however, share with their colleagues the technology-based learning projects they have implemented with students to develop their skills (Hodges & Prater, 2014). Moreover, schools can develop and implement formalized plans which outline the sequence of students' technology use in the classroom over several years. As this research has demonstrated, however, the technology plan should attempt to address the individual learning needs of students as they will invariably have different levels of ability in technology use based on the availability they have to different technologies at home (Fleming, Motamedi & May, 2007). Lastly, a classroom culture that builds trust between the teacher and students might encourage more hands-on uses of technology by the students.

Study limitations

Regarding the research limitations, there may be researcher bias in relation to the study outcome, as a result of his history of teaching in the field of gifted and talented education along with his interest in applications of technologies for learning with this student cohort. His perspectives, therefore, may have had an influence on the data collection and data analysis processes. In addition, it was not the case that all teachers who achieve a qualification in gifted and talented education become practitioners in this field. It is often the case that qualified gifted and talented teachers take on an administrative role or teach in mainstream classrooms only. A delimiting condition in the selection of participants included that the teacher taught in a gifted and talented related specialist position. The teaching goals and objectives relevant to mainstream classrooms versus gifted and talented classrooms are different.

At the time this study was conducted, elementary-school level gifted and talented education in Asir was mostly delivered via enrichment programs developed by school districts independently or by gifted and talented teachers themselves. Teachers in gifted and talented settings were afforded greater autonomy in the selection of learning content compared to their mainstream education counterparts. The different levels of control the teacher had in regard to curriculum decisions was a limitation of the study due to the level of influence they had over the teaching and learning content. The selection of teachers who indicated the frequent use of technologies for learning in their classrooms was based on the assumption that their perspectives of and attitudes towards teaching would differ from those of teachers who use technologies for learning with students only infrequently.

Lastly, participant selection was initially driven by existing survey data for evaluating the program. The nature of the data collected may therefore have been influenced by the fact all participants were graduates of the same program. Given the relatively small sample included in this study and the potential for the participants to demonstrate similar demographic and teaching history characteristics, the descriptions acquired in this multi-case study are not necessarily typical for all gifted and talented teachers. There is however, the potential for transferability of the findings to teaching settings similar to those of the participants in this study.

Further research

Further qualitative case studies research should be undertaken with more demographically diverse teacher participants to develop a broader understanding of the teacher-related factors influencing the frequency of technology use with gifted and talented students in the classroom. In addition, this study was conducted with teachers of gifted and talented students at the elementary school level. Future research should seek to identify the main curriculum planning and implementation requirements to influence the decisions around technology use in the classroom by teachers of gifted and talented students in secondary schools. This will provide a broader understanding of the teachers' and students' engagement with technologies for learning across the different stages of education. Lastly, the field would benefit from further research of gifted and talented students' experiences in using technologies for learning. This will provide scope to better understand the extent to which they feel their learning needs and preferences are being met and guide future decisions in the implementation of such technologies in the gifted and talented classroom.

Conclusion

Proficiency in technology use is an increasingly important skill for teachers and students both inside and outside of the gifted and talented classroom. It is crucial for teachers to develop a broad understanding of the affordances of technologies for learning and their potential for application in the classroom. There is an expectation that teachers of gifted and talented students will develop and implement meaningful and sequenced learning activities (ideally spanning several years) to develop students' technology use and literacy. Students need to develop the types of technology-use skill required to be effective 21st century learners in what is an environment of fast-paced technology development and changing pedagogical demands. As demonstrated by this qualitative research study, gifted and talented students' technology-literacy development is impacted shaped by the attitude of the teacher towards technology use, the type of technology available for use, and the pedagogical practices applied in the classroom.

References

[1] Battersby, S. L., & Verdi, B. (2015). The culture of professional learning communities and connections to improve teacher efficacy and support student learning, Arts Education Policy Review, 116(1), 22-29. https://doi.org/10.1080/10632913.2015.970096

[2] Bebell, D., O'Dwyer, L. M., Russell, M., & Hoffmann, T. (2010). Concerns, considerations, and new ideas for data collection and research in educational technology studies. Journal of Research on Technology in Education, 43, 29-52.

[3] Bielefeldt, T. (2012). Guidance for technology decisions from classroom observation. Journal of Research on Technology in Education, 44, 205-223.

[4] Brookfield, S. D. (2015). The skillful teacher: On technique, trust, and responsiveness in the classroom. John Wiley & Sons.

[5] Carver, L. B. (2016). Teacher perception of barriers and benefits in K-12 technology usage. Turkish Online Journal of Educational Technology-TOJET, 15(1), 110-116.

[6] Chai, C.-S., Koh, J. H..-L., & Tsai, C.-C. (2013). A review of technological pedagogical content knowledge. Educational Technology & Society, 16(2), 31-51. https://www.jstor.org/stable/jeductechsoci.16.2.31

[7] Clark, W., Logan, K., Luckin, R., Mee, A., & Oliver, M. (2009). Beyond Web 2.0: mapping the technology landscapes of young learners. Journal of Computer Assisted Learning, 25(1), 56-69. doi: 10.1111/j.1365-2729.2008.00305.x

[8] Clausen, J. M. (2007). Beginning teachers' technology use: First-year teacher development and the institutional context's affect on new teachers' technology use with students. Journal of

Research on Technology in Education, 39, 245-261.
[9] Clausen, J. M., Britten, J., & Ring, G. (2008). Envisioning effective laptop initiatives. Learning & Leading with Technology, 36(1), 18-22.
[10] Creswell, J. W., & Poth, C. N. (2016). Qualitative inquiry and research design: Choosing among five approaches. Sage publications.
[11] Domingo, M. G., & Garganté, A. B. (2016). Exploring the use of educational technology in primary education: Teachers' perception of mobile technology learning impacts and applications' use in the classroom. Computers in Human Behavior, 56, 21-28. https://doi.org/10.1016/j.chb.2015.11.023
[12] Fleming, L., Motamedi, V., & May, L. (2007). Predicting preservice teacher competence in computer technology: Modeling and application in training environments. Journal of Technology and Teacher Education, 15, 207-231.
[13] Flick, U. (2018). An introduction to qualitative research. Sage publications.
[14] Garcia, P., & Rose, S. (2007). The influence of technocentric collaboration on preservice teachers' attitudes about technology's role in powerful learning and teaching. Journal of Technology and Teacher Education, 15, 247-266.
[15] Garcia, P., & Rose, S. (2007). The influence of technocentric collaboration on preservice teachers' attitudes about technology's role in powerful learning and teaching. Journal of Technology and Teacher Education, 15(2), 247-266.
[16] Glassman, M., & Burbidge, J. (2014). The dialectical relationship between place and space in education: How the Internet is changing our perceptions of teaching and learning. Educational Theory, 64(1), 15-32.
[17] Groff, J. (2013). Technology-rich innovative learning environments. OCED CERI Innovative Learning Environment project, 2013, 1-30.
[18] Henriksen, D., Mehta, R., & Rosenberg, J. (2019). Supporting a creatively focused technology fluent mindset among educators: Survey results from a five-year inquiry into teachers' confidence in using technology. Journal of Technology and Teacher Education, 27(1), 63-95.
[19] Hodges, C. B., & Prater, A. H. (2014). Technologies on the horizon: Teachers response to the Horizon Report. TechTrends, 58(3), 71-78.
[20] International Society for Technology in Education. (2022). The ISTE standards. Retrieved from https://www.iste.org/iste-standards
[21] Johnson, R. B., & Christensen, L. (2019). Educational research: Quantitative, qualitative, and mixed approaches. Sage publications.
[22] Kafyulilo, A., Fisser, P., & Voogt, J. (2016). Factors affecting teachers' continuation of technology use in teaching. Education and Information Technologies, 21(6), 1535-1554. https://doi.org/10.1007/s10639-015-9398-0
[23] Lennex, L. (Ed.). (2014). Cases on instructional technology in gifted and talented education. IGI Global.
[24] Li, Y., Garza, V., Keicher, A., & Popov, V. (2019). Predicting high school teacher use of technology: Pedagogical beliefs, technological beliefs and attitudes, and teacher training. Technology, Knowledge and Learning, 24(3), 501-518. https://doi.org/10.1007/s10758-018-9355-2
[25] Marshall, C., & Rossman, G. (2016). Designing qualitative research (6th ed.). Sage publications.
[26] McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Teaching in a digital age: How educators use technology to improve student learning. Journal of Research on Technology in Education, 48(3), 194-211. https://doi.org/10.1080/15391523.2016.1175856
[27] Merriam, S. B. (2004). The role of cognitive development in Mezirow's transformational learning theory. Adult Education Quarterly, 55(1), 60-68. https://doi.org/10.1177/0741713604268891
[28] Neumann, M. M., Finger, G., & Neumann, D. L. (2017). A conceptual framework for emergent digital literacy. Early Childhood Education Journal, 45(4), 471-479. https://doi.org/10.1007/s10643-016-0792-z
[29] Nikolopoulou, K. (2020). Secondary education teachers' perceptions of mobile

phone and tablet use in classrooms: benefits, constraints and concerns. Journal of Computers in Education, 7(2), 257-275. https://doi.org/10.1007/s40692-020-00156-7

[30] Ozcan, D., & Bicen, H. (2016). Giftedness and technology. Procedia Computer Science, 102, 630-634.

[31] Park, C., Kim, D. G., Cho, S., & Han, H. J. (2019). Adoption of multimedia technology for learning and gender difference. Computers in Human Behavior, 92, 288-296. https://doi.org/10.1016/j.chb.2018.11.029

[32] Partnership for 21st Century Skills. (2009). P21 framework definitions. Retrieved from https://files.eric.ed.gov/fulltext/ED519462.pdf

[33] Periathiruvadi, S., & Rinn, A. N. (2012). Technology in gifted education: A review of best practices and empirical research. Journal of Research on Technology in Education, 45(2), 153-169. https://doi.org/10.1080/15391523.2012.10782601

[34] Pinhasi-Vittorio, L., & Ben-Yosef, E. (2014). A quest for re-scripting the narrative of education failure: Initial steps in a journey. Radical Pedagogy, 11(1), 1-25.

[35] Siegle, D. (2005). Using media & technology with gifted students. Prufrock Press.

[36] Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge–a review of the literature. Journal of Computer Assisted Learning, 29(2), 109-121. https://doi.org/10.1111/j.1365-2729.2012.00487.x

[37] Wade, W. Y., Rasmussen, K. L., & Fox-Turnbull, W. (2013). Can technology be a transformative force in education? Preventing School Failure: Alternative Education for Children and Youth, 57(3), 162-170. https://doi.org/10.1080/1045988X.2013.795790

[38] Zembal-Saul, C. (2009). Learning to teach elementary school science as argument. Science education, 93(4), 687-719. https://doi.org/10.1002/sce.20325

[39] Zimlich, S. L. (2012). Using technology in gifted and talented education classrooms: The teachers' perspective. The University of Alabama.