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Connected Education: Teachers' Attitudes towards Student Learning in a 1:1 Technology Middle School Environment

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Online and blended forms of learning has been increasingly common in K-12 settings, along with the technological advancement with always-on and connected devices. The study purports to understand teachers' attitudes towards the middle school's one-laptop-per-student (1:1) policy and students' frequent use of always-on and connected technology, as well as their concerns about middle school students' capabilities of using mobile devices and technologies in 1:1 environments. Using a transcendental phenomenological approach, data was obtained through semi-structured interviews, pre- and post- teacher open-ended surveys, along with classroom and lab observations. The study concluded that teachers typically embraced student use of school issued connected technology, as well as personal, connected mobile devices in a 1:1 environment. Meanwhile, teachers are cognizant of the potential drawbacks, implementing differing strategies to balance the use of such device for productive classroom learning and student engagement of personal non-course related activities. The pivotal role of teacher guidance is reiterated by teachers' perceptions of students' inability to engage in self-directed and self-motivated learning. The challenges reveal what middle school teachers' may face when planning a curriculum and instruction for connected digital age learners.

Keywords: 1:1 programs, teacher attitude, connected education, mobile devices, K-12 middle school

INTRODUCTION

Mobile technology has inundated modern society in the form of small always-on and connected devices that can be carried and accessed from nearly everywhere, enabling a wealth of continuous information. As society embraces this norm and technology-driven standards continue to emerge in education, preparing K-12 students for digital media use and information fluency is necessary. Along with such technology advancement, online learning, whether in the instance of full-bloom virtual schools or integrated blended programs, has become a prevalent form of education in K-12 school systems (Pourreau, 2015). Finding ways to leverage always-on and connected devices that are already embedded in the lives of school-aged youth, advances opportunities for flexible classroom activities that are not only useful in presenting content, but learner engagement as well. On a policy level, former U.S. president Barack Obama elevated the standard for K-12 schools during his White House tenure and pushed forward with the ConnectED initiative to empower both students and educators through technology use. This directive advanced a goal to equip the K-12 environment with enhanced wireless connectivity, interactive education lessons, and other digital tools needed to prepare students for the digital economy (The White House, 2015). With such thrust coming from government policy and legislation, more and more K-12 schools initiated one-laptop-per-student (1:1) initiatives integrated within their online or blended learning programs, providing each student with a computing device to use in school or at home (Keane & Keane, 2017).

As mobile devices and technology for learning continue to be prevalent in K-12 schools along with the thrust coming from the top, the need to understand how teachers perceive students' use of these connected technologies in the classroom is of paramount importance. Prior research has demonstrated affordances provided through these interactive tools that have been proven effective in varying scenarios such as multitasking, classroom engagement, and individual motivation toward learning for today's generation of connected, tech-savvy students (Clary, Kigotho, & Barros-Torning, 2013; DreamBox_Learn, 2014; Kee & Samsudin, 2014). While the current generation of school-aged youth is accustomed to always-on and connected mobile computing devices, the internet, and having a wealth of information at their fingertips, the frequent use of such devices in a K-12 classroom could also be challenging and even detrimental to a teacher's planning and the educational setting if not used and managed properly. However, despite the promises and potentials of using those mobile technologies, teachers are often faced with difficulties and challenges associated with integrating

such technologies into their classrooms through a variety of facets (Crompton, Burke, & Gregory, 2017; Hutchison & Reinking, 2011; Hwang & Tsai, 2011). Many K-12 teachers nowadays are expected to instruct in online or blended learning environments with these mobile technologies; however, research has shown that they may not have abundant opportunities to develop adequate skills in this domain (Wilkens, 2014). Understanding teachers' perceptions of their experiences managing mobile devices in 1:1 environments and their beliefs of students' capabilities of skill development would help improve technology integration training and practice, as well as provide more insights into how to make technology integration more effective in such environments.

1:1 Initiatives in K-12 Schools

Over the last few decades, with the ever-growing technological advancement and increased accessibility to computers and the internet, many students across all educational levels have had the opportunity to learn from a distance. In the mid 1990s, online K-12 schooling was born as a result of students and teachers leveraging the power of personal computers and the internet (Clark & Barbour, 2015). An increasing number of traditional K-12 schools have started to implement blended learning practices in order to achieve personalized instruction, blurring the dichotomy between virtual and brick-and-mortar schools (Patrick & Sturgis, 2015).

K-12 schools have been experimenting a variety of ways to leverage the power of blended learning, aiming to create a personalized educational experience where students have some level of control over the time and place of learning, their pace of learning, or the path of learning (Powell, Rabbitt, & Kennedy, 2014). It is important to note that 1:1 initiatives often can enable and leverage blended learning, but a 1:1 classroom does not automatically guarantee the existence of blended learning practices. Blended learning is defined as

> … a formal education program in which a student learns at least in part through online learning with some element of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home. (Christensen, Horn, & Staker, 2013, p.9)

Basic forms of blended learning include rotation, flex, and enriched virtual models (Christensen et al., 2013). For example, the rotation model

allows instructional modes to rotate from one learning modality (e.g. small-group work, individual paper-pencil work) to another (e.g. whole-class lecture instruction, video tutorial watching) given that one must occur online. The flex model uses online learning as the backbone of student learning, with a customized, fluid schedule to facilitate individuals' learning. The enriched virtual model focuses on a more immersive, whole-school online learning experience, while enforcing a certain amount of face-to-face instruction. While not all models of blended learning require 1:1 environments, they can make it easier to implement rotational models and are mandatory for the flex and enriched virtual models of blended learning.

Research has shown that an increasing number of schools at the secondary level have embraced and implemented various forms of 1:1 initiatives to support teaching and learning in the past decades as a model of blended learning (Balanskat, Bannister, Hertz, Sigillò, & Vuorikari, 2013; Donovan, Hartley, & Strudlerm, 2007; Penuel, 2006). The earliest 1:1 programs in the 1990s took the form of dedicated computer classrooms where students had access to computers in a lab setting, while others allowed students to rent or purchase laptop computers for use in school (Rockman, Chessler, & Walker, 1998; Spender, 1995). In recent years with decreasing cost of laptop computers and mobile devices, as well as access to wireless networks, schools have been able to provide more mobile and affordable solutions to 1:1 initiatives (Johnson, Becker, Estrada, & Freeman, 2015). In many K-12 school districts, 1:1 technology programs exist as a reform initiative to equip each student with a school- or district-supplied mobile computing device to support their learning activities (Convergemag, 2012; Sauers & McLeod, 2012). As society continues to shift towards embracing ubiquitous technology, numerous K-12 schools push programs that enable adolescents to leverage digital tools to explore and learn from rich and varied resources (National Middle School Association, 2010). One-to-one technology programs provide the incentive for school districts to provide digital-age learning opportunities, while affording students' access to information at school and at home (McLester, 2011). In a research synthesis analyzing 123 articles on 1:1 initiatives, Penuel (2006) summarized three defining features of today's 1:1 programs in a K-12 classroom: (a) students are provided with portable laptop computers for which up-to-date productivity software is installed, (b) students are provided access to the school's wireless internet, and (c) the use of laptops are aimed at helping students complete academic tasks.

In terms of the 1:1 program operation, Blackley and Walker (2015) reviewed the use of laptops in a 1:1 technology program across two middle

schools in Australia, exploring how the devices were being incorporated into mathematics. The study reported that half of the participants indicated that the laptops were definitely integrated into their mathematics teaching practice through routine access to the electronic textbook and email access; their use has also made it easier for teachers to provide essential feedback to students, assessing their tasks. Another study of a 1:1 laptop program in two Swedish secondary schools revealed how students used their laptops for both sanctioned and unsanctioned activities in the classroom (Tallvid, Lundin, Svensson, & Linstrom, 2014). The students were given unrestricted access during class, with no filters applied to the network; they were responsible for their laptop use twenty-four hours a day. Instead of allowing teachers to impose restrictions, the 1:1 steering group recommended that teachers have discussions with their students regarding the ethical use of the technology.

A great number of studies seemed to show positive outcomes of 1:1 technology programs in the areas of student engagement, motivation, and participation. Studies often report an increased level of engagement as a result of 1:1 initiatives (Bebell, 2005; Mouza, 2008; Warschauer & Grimes, 2005; Zucker & McGhee, 2005). For example, Broussard, Hebert, Welch, and VanMetre (2014) explored levels of student engagement derived from a newly implemented 1:1 technology plan that gave each student access to a tablet PC. Through a qualitative inquiry, it was found that teachers incorporated technology-rich internet applications to support learning as well as online classroom management software to organize instructional materials. Other reported benefits included an improved communication between students and teachers, access to Google and research databases, and reduced material usage per course. Additionally, several states including Indiana, Massachusetts, Michigan, and Florida revealed favorable findings from multiple empirical studies, suggesting an improved student engagement and motivation owing to the 1:1 technology initiatives (Bebell & Kay, 2010; Lemke & Martin, 2004).

Previous research also indicated merits of 1:1 initiatives in improving students' academic learning skills and performances. In a two-year experimental study at a struggling urban middle school, Dunleavy and Heinecke (2008) reported that students who received a portable laptop performed significantly better than students with no laptops on science and math standardized tests. The laptops were equipped with access to mathematics and science textbooks, as well as laptop-based instruction. Students with no laptops had access to the same resources in a school computer lab. Having access to math software programs and other online resources on a laptop may have

contributed to sixth grade students' improved score on benchmark examinations from the school (Clariana, 2009). Besides the areas of math and science, studies also reported affordances of 1:1 programs such as improving students' abilities in reading and writing. For example, in the state of Maine where 1:1 programs were implemented statewide across its middle schools, students' writing scores on state tests have risen significantly since the implementation (Silvernail & Gritter, 2007). In a similar vein, Suhr and his colleagues revealed an improved writing and literacy skills in fourth-grade students (Suhr, Hernandez, Grimes, & Warschauer, 2010).

Challenges of 1:1 Program Integration

Despite the positive results, research showed that the impact of 1:1 technology programs on K-12 student achievement and the educational environment can be either rewarding or arduous. Instances of 1:1 initiatives that failed and were therefore sometimes terminated (Holcomb, 2009; Hu, 2007; Sheppard & Brown, 2011) often occur as a result of various issues. The technical issues reported in several studies often caused tremendous disturbances and interferences to both teachers and students, becoming one of the major roadblocks to the success of 1:1 programs (Alberta Education, 2006; Argueta, Huff, Tingen, & Corn, 2011). Device and connection errors are cited as barriers in some instances where mobile technology and the internet was being incorporated in classes. For instance, in Lee, Messom, and Yau's (2013) research on the use of electronic textbook technology in class, it was noted that software compatibility across devices, readability of electronic media on a screen, and high bandwidth consumption when downloading and uploading content from the internet could pose problems in the class. These challenges were consistent with those found in another study (Liu, Navarrete, & Wivagg, 2014) where teachers were attempting to use mobile technology in the class. Derringer (2010) recounted one school district's technology director's experience with 1:1 implementation as a logistical nightmare, citing problems with batteries and operating systems, laptop damage, and infrastructure maintenance.

Broussard et al. (2014) reported challenges and issues such as distractions related to playing games on the device during class, academic dishonesty via the internet, slow internet connectivity, as well as technical issues such as computer malfunctions that plagued students and teachers during the day. Tallvid et al. (2014) reported students' unsanctioned use of the 1:1 device through non-educational activities such as chatting, playing games,

or pointless web browsing. In Blackley and Walker's (2015) study, students reported less than positive responses for using the devices with student productivity activities. For example, using laptops to construct spreadsheets were listed at 43.75% for seldom or never and drawing concept maps and diagrams were only listed at a frequency of 12.5% each. Consequently, teachers' decisions to leverage the 1:1 laptops for productivity applications in class for mathematics were either seldom or never used.

Furthermore, while 1:1 laptop and tablet programs are becoming more prevalent in K-12 education, school districts should be mindful of implementation strategies that align with curriculum goals and those that are less wasteful of resources (Warschauer & Tate, 2015). These strategies often move beyond a simple form of technology integration by pairing their 1:1 laptop initiatives with blended learning that also constitutes professional development to train teachers in helping students become active learners. A critical planning stage for how these mobile devices and technologies are going to be incorporated into teachers' daily curriculum becomes crucial to successful 1:1 programs (Downes & Bishop, 2015). A similar need of teacher mentoring was cited by Hechter and Vermette (2013) while exploring solutions to barriers to technology integration in a Canadian Province K-12 district. Ultimately, some of the abovementioned challenges can be mitigated by collaboration with a broader teacher network that works together to resolve those issues.

Teacher Beliefs and Perceptions of Classroom Technology Use

Though teachers on the forefront of education are often expected to align to changes and reforms demanded by the higher administration and government, they may not always transition the policy implications well to the classroom (Tyack & Cuban, 1995). Studies have shown that teachers' beliefs towards mobile phone or portable devices are not always positive. Lenhart (2012) found that in many schools the use of mobile phone by students was banned in schools, as teachers perceived them as a considerable disturbance to the traditional classroom. Plenty of K-12 schools in the United States have enforced or adopted strict policies prohibiting mobile phone usage in the classroom (Common Sense Media, 2009; Obringer & Coffey, 2007). According to the literature, researchers have reported plentiful drawbacks of using mobile devices brought to the forefront by teachers, including disruptions to the study environment (Campbell, 2006; End, Worthman, Mathews, & Wetterau, 2010; Gao, Yan, Zhao, Pan, & Mo, 2014), negative

impact on academic performance (End et al., 2010; Fox, Rosen, & Crawford, 2009), as well as cheating and academic dishonesty in tests and examinations (Campbell, 2006; Hurst, 2004; McAfee, 2012).

Research also showed that teachers have concerns over whether or not technology facilitates or hampers students' skill development. Bauerlein (2009) was adamant about adolescents' skill deficits and abilities for being productive, informed citizens. He attributed some deficits to youths' frequent immersion in mobile device screen-time by asserting that long hours of multi-tasking with text, visuals, and other digital media on a mobile device does not transfer well to their off-screen interaction. Greenfield (2015) also highlighted some of the characteristics related to digital technology use, such as screen addiction, and how the mind changes over time as a result of digital interaction. In a similar manner, Carr (2011) contended that continuous internet use conditions the brain to always want to connect to this medium and makes it difficult to concentrate on outside things, thus altering attention span. Computing devices and the internet puts information at your fingertips, which is beneficial in many instances, but seems to have presented challenges in the classroom for some teachers in this middle school setting.

Purpose of the Study

Across multiple studies, research highlighted the pivotal role of teachers, as they represent the action-takers who implement and practice the use of the technological devices in the classroom on a daily basis (Bebell & O'Dwyer, 2010). Research evidence also exhibited that teacher perceptions and beliefs exert a tremendous impact on the implementation and success of 1:1 initiatives (Lane, 2003; Trimmel & Bachmann, 2004; Windschitl & Sahl, 2002). As Bebell and Kay (2010) stated, the importance of individual teachers cannot be overemphasized to determine the success or failure of 1:1 computing. In other words, students' engagement and learning experiences with technology "are largely dictated by their teachers" and "the onus of responsibility for implementation often falls to the teachers" (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2010, p. 24).

Despite its importance, prior research documenting teacher beliefs and perceptions of 1:1 initiatives has been limited (Penuel, 2006). Though there have been studies attempting to understand how teaching beliefs and perceptions shape and influence teaching practices and behaviors (Ajzen & Madden, 1986; Ertmer et al., 2012; Ottenbreit-Leftwich, Glazewski, Newby,

& Ertmer, 2010), it is critical to further this investigation in the current context of 1:1 technology programs booming throughout the K-12 education arena, especially given the rapid change and transformation of today's technological advancement. Results of this study may also reveal possible obstacles that school districts and teachers may face when attempting to using 1:1 initiatives to facilitate the use of blended learning. The following questions were crafted to guide this study:

1. What are teachers' attitudes towards a middle school's 1:1 policy and students' frequent use of always-on and connected technology?
2. What concerns do teachers hold about middle school students' capabilities of using mobile devices and technologies in 1:1 environments?

METHODS

The research presented in this paper is part of a larger study using a transcendental phenomenological approach to examine teachers' experiences and beliefs about the 1:1 technology initiative at a middle school. This form of qualitative inquiry enabled flexibility in understanding how teachers made sense of the learning environment and students' use of connected technology, while also allowing a method for analyzing their meanings (Creswell, 2013; Moustakas, 1994).

Participants and Context

The inquiry took place in the United States at a suburban science, technology, engineering, and mathematics (STEM) middle school in a Midwestern state. The participants included five teachers of students from grades 5-8 and two facility administrators from the school (Table 1). Teaching experience of the participants spanned from four months to 20 years. The participants were intentionally selected through an internet-based survey, aiming to have a broad inclusion of teachers representing varying subject areas and experience levels.

Table 1
Overview of participants

Participant	Pseudonym	Role	Years of Experience	Subject Area
1	Mrs. Patton	Teacher	9	Teach Grade 5-8, Math/Arts
2	Mr. Smith	Teacher	<1	5-8th Grade, Technology Core
3	Ms. Long	Teacher	4	7th Grade, English
4	Mr. Brooks	Teacher	1	6th Grade, Science
5	Ms. Macy	Teacher	1	7th Grade Humanities/Social Studies
6	Mr. Jefferson	Administrator	20	English
7	Mrs. Ryans	Administrator	10	Math

The student enrollment at the school was approximately 630 from grades five to eight. Minority enrollment was about 50% of the entire student body, among which the majority were African Americans. About 50 licensed teachers worked at the school. Subjects taught in the school include mathematics, English, science, technology, and social studies. The school also offered specialized classes that have a STEM focus. For instance, classes on computer programming, robotics, the art of math, and design are also taught in the school.

The school became a STEM middle school within the past six years, after its initial operation as a traditional junior high school in the 1990s. The school's technology plan started with a Bring Your Own Devise (BYOD) environment, which allowed students to bring and use their own personal mobile technology devices such as smartphones, tablets, and iPods to connect to the school's wireless network. While the old BYOD plan leveraged student personal technology brought to the school, the new 1:1 Chromebook plan provided school-issued laptops to all of the middle school's students. The students were expected to keep and use the Chromebook during their entire time at the middle school and use it as a first option when accessing learning content in class. They were also allowed to bring their own computers if that was their preference. In such 1:1 environments, students were involved in various forms of blended learning where they could access learning materials and apps on their Chromebooks provided by teachers as well as have connectivity to a large creative learning space integrated with technologies such as a 3D printer, a laser cutter, CNC machine, and several student computer workstations. Those learning materials could also be again accessed and reviewed from home at the students' leisure.

Data Collection and Analysis

Following IRB approval, data was obtained through semi-structured interviews, classroom and lab observations, as well as a follow-up teacher interview survey. Research data was gathered following a four-step transcendental phenomenological process, including (a) epoche, (b) phenomenological reduction, (c) imaginative variation, and (d) synthesis of meanings and essences (Moustakas, 1994). Murray (2014) provides details regarding the data collection and analysis procedures. Hour-long, in-depth, semi-structured interviews with each participant were carried out, focusing on various topics related to technology integration in pedagogic practice. In the current study, we asked the participants to reflect on the following topics: (a) teachers' teaching style and/or strategy used within a connected environment, (b) students' learning patterns and behaviors observed in a connected environment, (c) teachers' ways or personal rules employed to manage the 1:1 classroom environment (d) the complexities inherent in an open 1:1 environment and how teachers cope with them, and (e) teachers' beliefs or philosophies about mobile technology's influence on middle school students.

We applied an open coding approach in the data analysis as it provides systematic means to develop codes and categories based on the data (Charmaz, 2006; Glaser & Strauss, 1967). The first round of data analysis began with placing participants' utterance in preliminary categories relative to the benefits, challenges, strategies, and beliefs that teachers had in the 1:1 learning environment (Table 2). The preliminary coding helped split our interview transcripts into smaller units, following a closer reading and constant cross-case comparisons analysis across each participant's response (Lincoln & Guba, 1985). Comparing each participant's response helped us identify similarities and differences, we consolidated the data and specifically looked for themes and patterns in each participant's responses related to (a) their attitude toward technology use in the classroom, and (b) concerns over how technology influences students' skill development in the 1:1 environment.

Table 2
Example of preliminary coding scheme

Initial categories to gain meaning	Excerpts from the teacher interviews
Benefits	"By letting them bring their own devices, or by using devices in your classroom, you free your classroom up to a much higher order of thinking." "You allow them to go out on their devices, you allow them to form opinions themselves and giving them scaffolding. In the past teachers were always the ones who had the information and they had to convey the information." "It can enrich the curriculum. It can definitely provide more options." "I have a couple students that like to have their paper up on their laptop and then actually Google search on their phone."
Challenges	"When the WIFI is down, Google is down. If a student's Chromebook is broken or lost, anything like that, it just kind of hinders what we can do." "They may want to bring up a discussion that's inappropriate because they watched a YouTube video at lunch about it. Those are things that are hard to manage, but they have to be done on a one-on-one basis." "It can also distract and it can also become a crutch, which is probably the worst negative." "Keeping them focused on one assignment, or one project for any extended period of time is a struggle because they are used to playing games."
Strategies	"I always have to make sure they know what the next step is so that there isn't down time." "I basically sit behind them and my chair is up higher so I can see all of their screens. Especially for test and quizzes. That way I make sure that even if they have that game app, or the game tab open, that they don't switch back and forth. That they actually focus on that one thing." "Whenever it comes to grading or lesson planning or setting up anything else, that's all on my laptop."
Beliefs	"It ruins human interaction. These kids could literally sit at home and never talk to a person. They could just text them, message them." "The schools that restrict this type of activity sucks." "They should use it as a tool. Just like any other tool they use. A pen is a tool. A pencil is a tool. There's a time and place for it." "I think we as a society have chosen to make them dependent on it. I don't like it, but I also understand some of it." "Being a STEM school we just believe in technology."

Limitations of Sampling and Data Collection

We acknowledge that there are limitations pertaining to the design of this qualitative study. Focusing on a single group of teachers and administrators from one middle school binds everything within the context of one middle school environment and restricts us from making more general, cross-case claims. Second, we did not include the perceptions of the student population at the school that are using their personal always-on and connected technology on a daily basis. In an effort to align to a reasonable scope (Baxter & Jack, 2008), this study only included a single group of adult teachers and administrators. Additionally, data collection only spanned from two-weeks of on-site visits and observations with follow-up surveys. More meaningful data could have been collected if the duration was longer.

Trustworthiness

In order to enhance trustworthiness, validity, and credibility of the data, we employed triangulation as a primary validation strategy that involves gathering information from multiple sources using multiple methods for research (Patton, 2002). This also echoes that the final step used in the transcendental phenomenological approach was a synthesis of meanings and essences (Moustakas, 1994). In this study, we used data from semi-structured interviews, classroom and lab observations, and a follow-up teacher interview survey. Primary data from interviews was validated by researchers' field notes documented during classroom and lab observations. The researchers conducted four in-depth, in-class observations. In an effort to minimize classroom disturbances, each classroom observation was limited by the administration to a set time of no more than 30 minutes. The researcher was also given a pass to roam through the facility and observe outside of the classrooms. One of the administrators conducted an hour long detailed tour of the facility to give the researcher a look into the programs, labs, and technical infrastructure therein. The researcher also applied the concept of *reflexivity*, which speaks to the manner in which a researcher is conscious about the experiences they bring to a study (Creswell, 2013). Multiple data sources helped with ensuring transparency of researchers' own bias and assumptions; this ultimately increasing the credibility and trustworthiness of the study. Additionally, we provided a thick description allowing readers interested in making a transfer to reach their own conclusion about whether or not transfer is possible (Lincoln & Guba, 1985).

RESULTS

In this section, we present the results of our data analysis regarding teachers' attitude of students' use on a daily basis as well as their concerns over the influence of technology in 1:1 environments.

Perception of the School's Acceptable Technology Use Policies

Each teacher participant weighed in on their thoughts surrounding the middle school's acceptance of students' always-on and connected personal technology. Most participants were well aware of the importance of adopting an acceptable use policy in the 1:1 connected environment and believed that it was overall beneficial. They believed that the policy enabled students to bring in and use their personal, always-on and connected technology to support both teaching and learning. As Mrs. Macy commented, "I think it has enhanced learning, allowing them to have their own Chromebooks at all times." She realized the benefits of working in this type of environment and knows that placing a device in every student's hand affords some flexibility in the classroom. The fact that students were already familiar with using various always-on and connected technologies to perform multiple tasks wirelessly and simultaneously makes things easier. Mr. Brooks acknowledged the benefits gained from technology with everyone in the class being connected; this may give the teacher opportunities to dwell deeper into the subject matter. He stated, "I think it is amazing that students can get questions answered and research anything they want in only a few seconds." He also believed that the connected environment could enrich the curriculum and provide more options for educators to streamline their time usage.

Meanwhile, a few teachers held mixed feelings toward the always-on and connected environment. While acknowledging the benefits, Mr. Brooks asserted that it could lead to misconceived thoughts regarding the teacher's role and become dangerous. He argued, "While positive and useful, the integration of technology in education and in this environment has to be used correctly." Ms. Long, who teaches English, expressed positive feelings for a facility-wide acceptable use policy, but did not believe students should be exposed to technology all the time. When asked about her overall feelings related to the facility wide policy, she stated,

> I love them, but not 100% of the time...I don't think it's good for students to be stimulated 100% of the time and them looking at a computer all the time all day in their classes when their brains are

> developing as rapidly as they are. For certain things, absolutely, research papers, typing papers, looking up information, but if it's just a group activity, they don't always have to make a PowerPoint or whatever.

Mr. Smith expressed mixed feelings about the school's acceptable technology use policies and felt that student grade level and age maturity makes all the difference of whether or not they should be allowed to bring and use technology in class. He stated,

> I don't think any of them at this level, maybe at the eighth grade level. But fifth and sixth graders and everyone having their own laptop is just insane to me. … I definitely think that it is useful to a lot of students that may need visual hands on learning. There is benefits to technology and learning like this, but there are pros and cons. Overall I think there are more cons to it.

While Mr. Smith felt that there are more cons than pros related to students using always-on and connected technology in this connected environment, an observation of his class revealed that he did exhibit a passion for demonstrating techniques for online spreadsheet use and internet research with his students. He would also stream digital music from his laptop while the kids worked on projects, as a way to reward good behavior. To this end, it does demonstrate his willingness to support student learning with technology; but at the same time he holds to his beliefs that there are some disadvantages.

Generally speaking, aside from a few cautious affirmations of student technology use, the majority of teachers do feel that the middle school's technology policies are useful and beneficial to learning, therefore they embrace the use of 1:1 technology in the classroom.

Setting Boundaries for Ubiquitous Technology Use in Class

In addition to seeing the pros and cons of ubiquitous technology use in the middle school, participants realized the importance of imposing boundaries to negate distractions via various approaches. As an example, Mrs. Macy set boundaries for students to use their Chromebook first, as the primary learning tool in class. Their personal technology is positioned as an alternative in class if their school-issued Chromebook experiences technical difficulties.

Mrs. Macy understood that if permitted to use both simultaneously, students would become distracted with games or social media interaction. She commented, "I actually see that when we have them with their own devices, specifically cell phones, I think they are a little more distracted with cell phones." Because of this, she left other personal devices open only as alternatives to their Chromebook.

Mr. Smith, a technology teacher and avid user of multiple connected devices, was open to student use of technology, but urged teachers to refrain from letting students do what they want, when they want with personal connected technology. He asserted,

> It's manageable, you just have to execute it and carry it out in the right way. You can't let them do whatever they want. They can't think that if they don't have it they can't learn. It's like they are going to die if they don't have their phone, so if you can get them out of that mindset.

Mr. Smith understood that students often have an emotional attachment to their personal devices, but contended that just because students have access to always-on and connected technology, it does not exactly mean teachers should just let them do what they want with them. He also felt that while he has to be stern at times to set boundaries for technology use, students should also take personal responsibility to be productive and manage their technology use of their own accord.

Mr. Brooks shared a similar philosophy, arguing that he allowed always-on and connected technology, but students have to be responsible for managing themselves as well. Approximately 40-50% of his students may bring additional technology to class daily and while it may be difficult managing them all, they are expected to take part in policing their technology use. Mr. Brooks commented,

> I'm ok with it. I believe they can handle it. I always expect the very best from my students and I think they'll surprise you. Students are constantly surprising you. But I can manage it, we can manage it. They can do what's expected of them, but it takes time, because in this world, now where we are going, what's going on, they have to be able to manage it.

When observing Mr. Brooks 6th grade science class, ubiquitous technology use by students was evident, as traditional hard-bound books were replaced with connected 1:1 laptops and a high percentage of the class had their own smartphone devices as well. Shortly after the researcher's arrival, the

students were instructed to put their games and personal phones away, then go into their online Google Classroom environment to engage in a learning activity. As Mr. Brooks presented an interactive plant growth simulation on the classroom smartboard, he would move about the room to make sure the students' laptops reflected the illustration on his screen. Then, he would set a synchronous questionnaire so they could chime in from their laptop. This engagement and monitoring technique was beneficial, as students' would have to pay attention to both his lecture and the interactive demonstration to answer questions properly. They also had to police their own use of personal technology and internet use to stay on task with the activity.

Furthermore, Mrs. Patton, an advocate for technology integration in teaching and learning, was open to students using always-on and connected technology in class, but maintained that they must be managed. She stated,

> Basically in my classroom when I'm mentoring other teachers I always tell them "set your line." So, if it's ok to have your technology out, that's fine, but tell your students, "If you have your technology out when it's not appropriate time to have your technology out, then yes, you are crossing that line and I will be happy to hold it for you." It does need to be managed.

Not only did Mrs. Patton manage the use of always-on and connected 1:1 laptops and student smartphones, she also monitored the appropriate use of other applied technologies in the creative lab space. For example, during a class visit students demonstrated the use of digital design software, 3D printing machines, and a variety of fabrication tools used for applied math and art activities. Mrs. Patton successfully balanced the role of teacher, technology manager, and monitor of student engagement. While she did support the 1:1 Chromebook use and advocated for always-on and connected technology use in class, she was cognizant of the ways in which technology can distract learning if not managed properly.

Teachers' Understanding of Middle School Students' Capabilities

Participants overall expressed concerns over middle school students' capabilities for being "free agent learners" that would allow them to explore diverse topics of their choice, on their own with minimal guidance and support from an adult.

Underdeveloped social skills. This theme is a result of the participants' shared views on various ways in which always-on and connected student

technology affects the students' social skills. Participants believed that their students' social skills aren't being fully developed as a result of their frequent interaction with always-on and connected technology. For example, it has been observed that frequent technology use has contributed to difficulty having one-on-one communication without a device, an inability to communicate intelligently, and a lack of drive for overall human interaction. Mrs. Patton described the lack of social skills that is observed daily from her students and contends that it is a skill that she often has to teach. She stated,

> What I'm finding is that I am having to teach social skills. To be in sixth grade and not be able to have an intelligent conversation with somebody is a skill that is totally not in their skillset anymore. Many of them have not been taught how to agree to disagree and they instantly want to go to their media and "I want to post this and say this."

Teachers believed that as a result, students' ability to sit down and have a conversation with someone is somewhat diminished, because they are constantly interacting with their always-on and connected technology through texting and social media posts. Consequently, any social interaction that needs to happen outside of this is limited. For this, Mrs. Patton summarized, "that is a skill that I find I am having to teach, because of their devices."

Moreover, when discussing the manner in which always-on and connected technologies contributes to student abilities with Mr. Smith, he bluntly stated that, "It ruins human interaction. These kids could literally sit at home and never talk to a person. They could just text them, message them. You would never have to see any one. Some of these kids are impaired with their reading and social skills because they don't use them."

Mr. Smith's argument was similar to that of Mrs. Patton, who also recognized that student social skills and human interaction are displaying areas of concern. He added that this dependency on personal always-on and connected technology at the middle school level may affect them later on in high school and beyond stating, "I think it will start to affect them once they get pass [past] the high school level and have to go to job interviews and have to stand in front of the man and have to answer questions." Mr. Smith gave a critical view of how vulnerable students are at the middle school level and warned that lack of social skill development with his students could be detrimental to future career opportunities since they are so reliant on technology. His concern of social skill development and technology reliance was understandable after observing class change and lunch hour. At those instances, there was noticeable student fixation on personal technology use,

favoring it over one-on-one, face-to-face human interaction.

Similarly, Mrs. Macy equated students' frequent use of technology as "having the world in your hands." If a student wanted to know the name of a song on the radio, they wouldn't be required to talk to anyone because simply pushing a button on your device will find the answer.

Mr. Brooks described what he has found to be inadequate human interaction skills, but attributed students diminishing skills to the times in which we live, where being intellectual is not always favored, but having the latest technology is. Mr. Brooks discussed what he perceived to be underdeveloped social skills when students' are communicating face-to-face. He noticed that students appear to be more comfortable typing their opinions in their devices then they are having an actual human interaction. He mentioned that it is somewhat commonplace for a student to talk to you with their head down, as if they are texting someone. He added,

> I find it disturbing that they have a hard time talking to me face-to-face. So if I have a student or a few students stay after class for this thing or the other, they have a hard time forming sentences sometimes, because they don't know how to say it out loud. I feel like sometimes they're afraid of their own voice and we live in a society where we want to enhance the voice that young people have. When I say voice, I mean their ability to change modern culture. They're afraid to speak on what they believe. It's so much easier to type and to say to one person and actually hear yourself say it.

Finally, each participant's perception of technology and student interaction elicited a consequential meaning to what has occurred due to students' frequent interaction with their always-on and connected devices. Participants believe that rather it be a one-on-one conversation or some form of intelligent conversation, student capabilities are lacking outside of what their technology can support. This was also reflected in a few of the classroom and other facility observations, as students seemed to be fixated to their connected screen devices, choosing this medium over one-on-one peer interaction.

Research and writing skills. Participants showed concerns with students' research and writing skills as a possible result of over-dependency on technology and the internet. Mr. Brooks expressed his frustrations with their research and problem solving skills. He described that students would equate research with using Google to answer everything, providing answers that are well beyond their knowledge level. To address this, Mr. Brooks will ask them "where did Google get it from?" He further elaborated,

> Right now, in their mind, to solve a problem, they have to Google it. Well, that's not always going to be true. It kind of stifles creativity and the whole thing about this STEM school and the idea of education is to create creative innovators that will be able to literally change the world as we perceive it.

On the other hand, Ms. Long's frustration was caused by students' inability to spell and write properly. She stated, "I think that the biggest problem that I have seen is they do not know how to spell. If they don't have spell check, they are completely lost." She believed that when students are not on their devices their writing and spelling skills are not as strong as they should be at their respective middle school level. Over-reliance on the devices also leads to even more severe issues. As she stated,

> Yes, it also leads to plagiarism, which is one of the biggest things I'm working on right now before they do their research paper. They think that because they find it on a website, then it's right. They don't know how to, like when I was in high school the teachers were like "don't use Wikipedia". That's not, anyone can change it. Now it's almost an acceptable site to use.

To combat this behavior, Ms. Long typically presented good and bad examples of researched content so that students could gain a better perspective, but this was sometimes met with difficulty. She stated, "The hardest part is getting them to read the entirety of the website." Sometimes students would only read a few sentences and go with the answer. Likewise, Mrs. Macy described some of the same behaviors from her students when engaging in research via their always-on and connected technology. Similarly, Mr. Smith had experienced this with his students and discussed students' conditioned behavior of frequently using their technology to take shortcuts. He stated,

> Time is money to them. The less time that they are doing schoolwork, the more time that they are having fun. They are always going to take the shorter route. Then you have access to this stuff, it's just going to be 10 times faster than going into a library, encyclopedia, or any kind of resource that's not electronic. It's just going to take longer.

Further, Mrs. Patton articulated that it is a challenge getting students to understand that there is a process that they must go through to obtain accurate information. She stated that they have been taught how to obtain information correctly and that the answer is not always immediate, but still seek

the fastest route to completion. The amount of information they can access via their connected technology puts them in a rush and they do not follow an adequate process that leads them to accurate results. She further stated,

> I think it's how they sooth themselves and I don't know that that is good or bad. But I do know that there are other things that are lacking because of it. But who's to say that that won't be a more useful skill in the future. We can't predict that.

In brief, the participants revealed various behaviors demonstrated by students when completing class assignments involving research and writing. The teachers discussed students' reliance on their connected technologies and the internet to support research and writing activities, but desires for immediate answers often resulted in inaccurate responses.

Minimal capabilities for self-directed learning. Participants all shared concerns related to middle school students' cognitive abilities to guide their own learning and development. Four out of the five teacher participants did not believe that middle school students were capable of guiding their own learning in an efficient and productive manner without support. For example, Ms. Macy felt that at this age level most students are still developing these characteristics and have yet found that subject that they are fully passionate about. She stated,

> At this age level I would say that it is developing. It's not impossible, but it's certainly not at a mastery level for them to be self-guided completely at this young age where their adolescents is…At this point of life, some of them, I can't speak for all of them, they don't have the drive of, I want to learn about this subject, I want to excel. It's kind of like, alright I want to make it to eighth grade... So it would be hard for them to put their heart into self-motivating.

Likewise, Mrs. Long believed that a small percentage of students in this school could achieve a certain level of self-direction. She thought that although students' technologies are capable of supporting them by making content accessible anyplace and anytime, at this age they are still developing constructive ideas about correct and incorrect information. Ms. Long shared,

> The biggest problem with that is if they find wrong information, they don't know that it's wrong if it's only self-directed. And also, as far as teaching there are certain standards that you have to hit. So I might say you need to research the main idea or something like that. They may think in their head that the main idea is something different. Or half listen to the directions and go and try to learn it themselves and they don't know what's going on.

Due to the minimal capability to perform self-directed learning activities, many participants stated the important role of teachers in providing guidance. Mr. Smith suggested that students should be directed by someone to keep them on the right track because students at this level may become distracted by their connected devices. He suggested, "There should be someone that they are following that knows more, at least someone to tell then when they are wrong". Agreeably, Ms. Macy argued that the presence of an adult keeps students aligned to what they are supposed to be doing. She stated, "I think at this point yes, it should be facilitated by a teacher. Only because of the distractions that the internet provides on cell phones and that their device provides. There has to be some kind of monitoring." Likewise, Mrs. Patton felt that middle school students' are still forming core ideas and all will not have gained the skills for self-directed learning yet. Similarly with her colleagues, she recognized students need teacher guidance.

One participant, Mr. Brooks, expressed more optimism toward students' ability, but he also highlighted the role of teacher guidance, as students in this age group still will not be able to totally elude the support of the teacher to embrace the full role of a free-agent learner. As Mr. Brooks stated, "Yes, children, students, they have the ability. They'll surprise you every time, but you have to take great care to scaffold that type of understanding. If you just throw it at them, you are going to be running into a brick wall."

DISCUSSION

Our findings revealed that the majority of teachers had a positive outlook and were open to using always-on and connected technology to support teaching and learning in the classroom as they have been exploring various means of blended learning in the 1:1 middle school classroom. Teachers discussed the possibilities of embracing and leveraging Chromebooks for content delivery, student engagement, and to access internet-based resources for learning. Meanwhile, several teachers raised concerns over the downsides of students' immersion in an always-on and connected technology environment. They did not believe students should be fully exposed to technology 100% of the time at this age and it is incommensurate with their cognitive development. Consequently, teachers discussed varying approaches they employed and observed in order to mitigate the potentially negative influence of devices and technologies in the 1:1 blended learning environment. To reach the expected educational goals in such environments, they placed a critical emphasis on setting boundaries in the classroom when

managing students' behaviors related to using always-on and connected technology. We believe these results regarding teachers' attitudes are largely consistent with prior literature, highlighting both benefits and drawbacks of the 1:1 environment and students' technology use in the classroom as perceived by teachers (Blackley & Walker, 2015; Broussard et al., 2014; Gao et al., 2014; Sauers & McLeod, 2012; Tallvid et al., 2015).

Overall, teachers and administrators in this study showed grave concerns over middle school students' capabilities of acting as self-directed and self-motivated learners with the support of their always-on and connected technology. According to national research findings, it was reported that today's K-12 students were adamant about being free agent learners who were able to take control of their education through self-directed technology-based methods, using mobile devices and social media tools to find the information they want to know to support their own personal development (Project Tomorrow, 2010). Though the concept of *free-agent learners* is appealing, obviously teachers in this study were more pessimistic about their students' capabilities for self-guided learning by means of always-on and connected technology. Teachers' reflections on their students' behaviors and habits observed from their classroom activities showed that the development of their research, writing, and metacognitive skills may be at risk if used improperly. Particularly, students' interconnectedness and desire to gain answers immediately induces behaviors of academic dishonesty, lackluster problem-solving skills, and limited writing skills that teachers either have to un-teach or constantly monitor. Such beliefs were congruent with findings and implications among previous studies (Bauerlein, 2009; Carr, 2011; Greenfield, 2015). Additionally, this finding also implies potential obstacles that teachers will face when using 1:1 initiatives to support blended learning. Since blended learning requires some student control over their learning time, place, pace, and path, working with students who have underdeveloped self-directed learning skills would mandate additional teacher guidance and scaffolding to accommodate the students' level of self guidance.

After all, teacher beliefs and attitudes are complex constructs influenced by various internal and external factors including their personal, fundamental belief and self-efficacy towards technology, as well as the training and professional development they received as part of their own experiences (Ertmer et al., 2012; Sauer & McLeo, 2017). It is interesting that although teachers showed serious concerns of student skill development, most teachers expressed favorable views of the school's 1:1 initiative. Context is another factor that needs to be taken into consideration when interpreting findings of the study. Contextual and structural factors such as the school's de-

mographics, cultural and territorial characteristics can also influence teachers' attitudes towards technology (Meelissen & Drent, 2008; Wastiau et al., 2013). Views of the teachers in this particular school can hardly represent another school that has a different student makeup and demographic range. In order to modify teachers' beliefs, more training and professional development needs to be in place in addition to attending to the contextual and environmental constraints as fundamental changes do not occur rapidly or automatically.

CONCLUSION

Outcomes from this study provide additional evidence for the current literature base and offer insights to improve practice with regard to 1:1 initiatives as a way to promote online and blended learning at the secondary level. The study provides a snapshot of a middle school's 1:1 implementation and reports on teachers' views toward this implementation. The study concludes that teachers typically embraced student use of school issued connected technology as well as personal, connected mobile devices in a 1:1 environment. However, teachers were cognizant of the potential drawbacks, implementing differing strategies to balance the use of such devices for productive classroom learning versus student engagement of personal non-course related activity via their devices. Teachers' mixed attitudes seen in this study is consistent with findings in prior literature. Our findings also re-emphasize the pivotal role of teacher guidance in any type of 1:1 initiatives or blended learning environments. Without teachers' instructional guidance and support, middle school students are likely to indulge in non-academic activities due to their inability to engage in self-directed and self-motivated learning. The challenges presented in this research reveal what middle school teachers and other educational stakeholders may face when planning a curriculum and instruction for connected digital age learners.

Outcomes from this study help to identify several areas of future research. We believe that further research is needed in this area as digital technologies and devices continually change, bringing new challenges for teachers and school administrators aiming to incorporate such technological advancement into pedagogy and their curriculum. In addition to examining teacher beliefs, we encourage future researchers to delve into teacher practices and student reaction regarding the use of always-on and connected technologies in a 1:1 environment. Finding instruments and parameters to measure the success of 1:1 continues to pose a challenge due to the multi-

faceted nature of this type of research. Though *effect* studies that truly measure the impact of 1:1 programs are extremely scarce (Penuel, 2006), we recommend additional efforts within this area to provide insight for the cost-effectiveness of such programs and additional evidence to warrant their investment. We also recommend taking considerations of various stakeholders inclusive of administrators, teachers, parents, and students, to provide a more holistic view of 1:1 program integration. Methodologically speaking, we recommend future researchers to conduct a replication study that carries a larger sample size, which will increase the validity of the study and generalizability of findings. We also recommend a longitudinal study that may help identify a change in teacher beliefs and teacher practices. Lastly, for researchers who specifically study 1:1 schools that are using the technology to facilitate blended learning initiatives, we recommend focusing on gaining insight into how the 1:1 initiatives impact blended learning, the challenges 1:1 initiatives may have engendered within this age group, and the strategies that teachers and school districts employ to resolve said challenges.

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