Teacher Perception of Barriers and Benefits in K-12 Technology Usage

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ABSTRACT
This study explores K-12 teachers' perceptions of the benefits and barriers to technology integration by either teachers or students in K-12 instruction. The sample was composed of 68 students enrolled in online classes in the graduate studies in education department of a small private liberal arts institution in the southeast. Data was collected using an anonymous, online survey. Open and axial coding was used to identify themes in barriers and benefits in both student and teacher technology use. Even with the emphasis on providing 1:1 technology, availability of technology was most frequently identified barrier, while increased engagement was the most frequently identified benefit. Content instructional issues or teacher knowledge were not as stronger identified barriers or benefits.

INTRODUCTION
Since the advent of computers in the mid 1970s, educators have extensively discussed the potential they have for helping to improve student learning (Hew & Brush, 2007). The possibilities seemed endless, but originally the ratio of students to computers was too high to allow for frequent usage. The ratio of students to computers in 1983 was estimated at 168 to 1 (Anderson & Ronnkvist, 1999). Since that time there has been an influx of new computers and digital devices as schools attempt to meet the academic needs of the 21st century learner.

The National Center for Educational Statistics (IES, 2010) reported that 97% of United States teachers had at least one computer in their classroom every day with 93% of those computers having Internet access. They found that the ratio of students to computers was 5.3 to 1. However, only 40% of the teachers interviewed reported that they often used computers during their instruction. But computers are not the only technological options open to educators. Schools have recently experienced an increase in the types of information and communication technologies available. Most schools currently have high speed Internet access as well as other digital equipment such as printers, video projectors, digital white boards, iPads, iPods, and smart phones. These expanded technology options have transformed the educational landscape (Robinson, McKenna & Conradi, 2012).

Even though schools have embraced the digital revolution, reading and mathematics test scores are at about the same level that they were 40 years ago (National Assessment of Educational Progress, 2013). Consequently as Kozma (2003) indicated, it is evident that the positive impact of technology does not happen automatically. Its impact is determined by how teachers use the technology in their classroom instruction, not just the acquisition of technology.

THE STUDY
This study explores K-12 teachers' perceptions of the benefits and barriers of educational technology when used by teachers or students in K-12 instruction. Data was collected using an open ended qualitative survey format from a sample of students enrolled in online classes in the graduate studies in education department of a small private liberal arts institution in the southeast. The students were invited to complete an anonymous survey about their perceptions of the benefits and barriers to their use or their students' use of educational technology.

REVIEW OF LITERATURE
Students come to the classroom ready to use technology to explore their world. Research has indicated that technology can increase student motivation, attitude, engagement, and self-confidence, while improving organization and study skills. All these factors taken together were found to significantly improve school attendance and academic performance (Warschauer, 2006). Spektor-Levy and Gronot-Gilat (2012) determined that students who were taught in a 1:1 digital environment outperformed students who were taught in a more traditional classroom when given a complex, computer-based learning task. Using a researcher designed computer based instrument, the researchers found that students from the 1:1 digital classrooms significantly outperformed their peers in 9 of the 15 literacy skills assessed. This improved academic performance is particularly important because many of the high stakes standardized assessments are currently technology based

(WGBH Educational Foundation, 2014). However, Dawson (2012) found that the technology benefits were not just academic. He reported that computer usage also resulted in better teacher-student and home-school relationships.

Many states have developed technology goals. Florida has identified five educational goals. The third goal, *Florida's Digital Educators* is to "empower educators with the skills necessary to integrate technology to improve students' rates of learning" (Florida Department of Education, 2006, para. 4). Although the goal is technology integration, this has been defined in a variety of ways. Hew and Brush (2007) defined it as the use of computing devices for instructional purposes. These devices could include desktop computers, laptops, iPad, iPods, smart phones, handheld computers, software, and Internet resources. However, teachers through their lesson planning impact the actual technology practices in any school (Spektor-Levy & Garanot-Gilat, 20012. Consequently it is important to determine the factors that enhance or restrict teachers' technology implementation.

World-wide teachers are struggling to find the most effective ways to integrate technology into their instruction (Nyagowa, et al., 2013; Orlando, 2013; Peeraer & Van Petegem, 2012). Hutchison and Reinking (2011) in their survey of 1,441 United States educators found a significant gap between teachers' perceptions of the importance of integrating technology and their classroom use of these skills. On a Likert scale ranging from 0 to 3, the mean teacher perception of importance for evaluating information online was 2.08, but the mean frequency of classroom use was only 1.03 (Hutchison & Reinking, 2011, p. 322). This difference of -1.21 indicated that teachers thought students should be able to evaluate information online, but they did not incorporate those skills into their instruction. The United States is not the only place this phenomenon occurred. Jordanian teachers reported rarely using technology for educational purposes (Al-Zaidiyenn, Mei, & Fook, 2010), while in Tanzania, the integration of technology into classroom learning rarely occurred despite several national initiatives aimed at improving technology integration (Mwalongo, 2011).

Technology integration can be impacted by a variety of different factors. Ertmer et al. (1999) classified barriers into first and second order barriers. First-order barriers would be those that are outside of the teacher, such as a lack of resources. While his classification is dated, the concepts hold true today. Multiple research studies have identified potential obstacles to technology integration (Hew & Brush, 2007; Spektor-Levy & Gronot-Gilat, 2012), one of the most common is a lack of technological tools which would be an example of a first order barrier. Second-order barriers would be those that occur because of factors within the teachers, such as their attitudes or skills.

Hew and Brush (2007) in their meta-analysis of 48 studies on technology integration classified the identified barriers to integration into five main categories: resources, knowledge and skills, institutional attitudes and beliefs, assessments, and culture. In their analysis they found that the first two categories, resources and knowledge and skills were most often identified. Consequently this study focused on these two barriers. They were analyzed more extensively in an attempt to understand the barriers caused by the resources and lack of skills. The resources category would be a type of first-order barrier and would include such factors as access to the technology, time, and technical support. They found that factors such as the amount of technology, where the technology is housed, ease of access to technology, and the limited number of technical support personnel all impacted teachers' decisions about whether to integrate technology in their instruction.

Ertmer (2005) indicated second-order barriers such as the teachers' perception of their knowledge and skills were important because these factors impacted whether the teachers chose to use the available technology in their instruction. He argued that teachers need effective technology integration professional development that focused on content appropriate technology and skills, provided hands on opportunities, and addressed teachers' needs.

Another barrier to digital integration could be teachers' technology skill levels. Moradi-Rekabdarkolaei (2011) administered the ICT Literacy Assessment to 384 secondary students and 367 teachers in Iran in an attempt to compare teachers' and students' technology proficiency. The ICT Literacy Assessment measured "cognitive problem solving and critical thinking skills associated with using technology to handle information" (Moradi-Rekabdarkolaei, 2011, p. 45). Moradi-Rekabdarkolaei, (2011) found a "meaningful difference between the ICT literacy of teachers and students" (p. 43) with the students scoring higher than the teachers on all areas of accessing, managing, integrating, evaluating, and creating information. The teachers involved in the study indicated that they were reluctant to use technology in their classrooms because they felt deficient in their technology skills. Teachers' lack of proficiency could explain why educators are not yet integrating technology into their instruction. This lack would be a second order barrier.

However, Waycott, Bennett, Kennedy, Dalgarno, and Gray (2010) questioned whether there was a digital divide between students and teachers. Although students are often referred to as "digital natives" (Waycott et. al., 2010, p. 1202), the research revealed that their "digital immigrant" teachers were just as likely to embrace technology (Waycott et. al., 2010). The authors found that assuming teachers are reluctant to integrate technology due to a resistance to technology was a misconception. Perrotta's (2013) findings supported Waycott et al (2010) and he further warned of the dangers of "bashing" teachers and portraying them as "outmoded, obstructive, or ignorant" (p. 325) simply because they continued to utilize traditional instructional methods. When Perotta (2013) surveyed 683 teachers in 24 secondary schools across the United Kingdom, he discovered that conflicting expectations and school-level circumstances were more significant determinants to technology integration than the individual characteristics of the teachers.

DESIGN

Technology integration could be examined in various ways; through first person perception expressed in surveys, teacher observation studies comparing teacher technological practices, and action research. This study used a qualitative survey to analyze teachers' perceptions.

Three hundred and ten students enrolled in online classes in the graduate studies in education department at a small private liberal arts institution in the southeast were invited to complete an anonymous survey regarding their technology usage, and the barriers and benefits K-12 teachers and students experienced when using educational technology. The graduate students were sent an email containing a link to the anonymous online Qualtrics survey. The email explained the purpose of the research, that participation was voluntary, and that all responses would be anonymous. The study sought to answer the following questions.

1. What factors impact technology use in K-12 instruction by teachers enrolled in online graduate studies in education programs?
2. What factors impact how teachers enrolled in online graduate studies in education program incorporate technology in their K-12 instruction?
3. What K-12 digital instructional benefits and/or barriers were identified by K-12 teachers enrolled in online graduate studies in education programs?

Email invitations to participate in the study were sent to the 310 students enrolled in the three online graduate studies in education programs: Exceptional Student Education, Reading, and Educational Leadership. Using a mixed methods survey design, the study explored K-12 teachers' perceptions of the benefits and barriers of educational technology when used by teachers or students in K-12 instruction. The sample of convenience was composed of 68 students enrolled in online classes in the graduate studies in education department of a small private liberal arts institution in the United States. Data was collected using an anonymous, online survey. The students were invited to complete the anonymous survey regarding their perceptions of the benefits and barriers to their use or their students' use of educational technology and the types of and frequency of technology used in the K-12 classroom.

The survey was comprised of quantitative and qualitative questions. First, nominal measurement scale demographic information was collected for each respondent to ascertain the grade and subject level of the teacher respondents. Demographic data provided the researchers with a rich description of the sample who participated in the research. Next, using an interval measurement Likert scale, the researchers surveyed the frequency and types of technology utilized in the classroom by both teachers and students. Factors assessing teachers' and students' utilization frequency and type of technology integrated in the classroom were analyzed using percentages and frequency counts. Finally, four open-ended qualitative questions assessed teachers' perceptions to barriers and supports for integrating technology in the K-12 classroom. Factors impacting teachers' and students' technology use, and teachers' perceived benefits and barriers were analyzed using axial and open coding methodologies to identify themes. All qualitative data was coded by each researcher for interrater reliability. All quantitative and qualitative data was corroborated and triangulated to ensure the validity of the results

RESULTS

Analysis of demographic information revealed most respondents (74%) taught in the areas of reading and/or language arts. Nearly two-thirds identified they taught in STEM classes (math and science) while fewer than 10% taught elective classes. The majority of respondents indicated they taught primary (K-2) elementary school (41%) with one – third (33%) indicating they taught intermediate (3 – 5) elementary and middle school. Less than one-fifth of the respondents indicated they taught high school (19%). The majority of the respondents appeared to be elementary teachers on the kindergarten through fifth grade level who taught multiple subject areas.

With regard to technology utilized in the classroom and with what frequency, most respondents indicated they used a computer (100%) and digital projector (89%) at least weekly with most indicating they used a computer (93%) and a digital projector (85%) daily. Approximately half of the respondents indicated they used an interactive white board (56%), digital camera (48%) or iPad (47%) at least once a month. Nearly three fourth of the respondents (77%) indicated they never used text messaging in their classrooms and half (50%) indicated they never used smart phones in their instructional delivery.

Respondents were asked four open-ended survey questions:

1. What are some of the barriers you face in implementing technology into your daily classroom instruction?
2. What are some of the benefits you experience when implementing technology into your daily classroom instruction?
3. What factors impact the frequency with which you as the teacher use various types of educational technology?
4. Which factors impacted the frequency and purposes for which your students use educational technology?

Each researcher coded the data and reviewed it for inter-rater reliability. During this process, the researchers debriefed to identify any variations in coding and coexistent themes. Following the interrater reliability check, the researchers finalized the data results in overarching themes leading to recommendations. Data interpretation allowed the researchers to theorize toward developing patterns and meanings or in other words to "make sense" of the data. Using an analytic inductive reasoning process, data coding and concomitant interpretation, the researchers were able to:

1. Ascertain the common themes or recurring regularities that emerged from the data (Patton, 2002). This entailed internal homogeneity or the extent to which data belonged to a certain category or theme or dovetailed with a category of theme. This also entailed external heterogeneity or the extent to which the data did not belong in a category and to identify that the differences between categories was clear (Patton, 2002).
2. Test the data for convergence, or identify how the data did not make connections with themes or categories or align with the research questions and broader environmental scan purpose.
3. Identify deviations from the common themes and, when possible, to provide explanations of the deviations. Deviant cases or data that diverged from the categories or themes was given careful consideration and examination as to why it did not "fit" into the categories or themes.
4. Bring forth the stories or a narrative enquiry that emerged from the data analysis from which to draw recommendations.
5. Bring forth patterns or themes that may suggest additional data that needs to be collected.
6. Align the themes and narrative stories that emerged with the review of literature.

Data analysis and interpretation provided the structure for the ensuing results, analysis, and recommendations. Interrater reliability was evident in the themes identified. Overwhelmingly, based on the work or classification system developed by Etmer, et al., respondents indicated first order barriers to technology use. The availability of the technology impacted teachers' decisions as to when and whether they utilized technology. Approximately three-fourths of the respondents identified first order barriers while one fourth identified second order barriers. Four different types of first order barriers were identified. The preponderance of the respondents (80%) were concerned about the amount and availability of technology. Though not as significant, the location of the technology, the amount of student instructional time, and the availability of technical support personal were also identified as barriers (See Table 1).

Table 1: *Teacher Perceived Barriers to Technology Use*

Total of 54 Barriers Identified	Number*	Percentage
Total First Order Barriers Identified	41	76%
Amount of Technology	33	61%
Location of Technology	3	6%
Amount of Instructional Time	3	6%
Availability of Support Personnel	2	3%
Total Second Order Barriers Identified	13	24%
Teacher Knowledge and Skills	13	24%

*Note. Number of responses based on 54 barriers identified.

Increased student engagement was the most frequently perceived benefits of incorporating technology. About half of the respondents (59%) indicated that the use of technology increased student engagement. A quarter of the respondents indicated the benefit of increased student understanding. The remaining quarter of the responses

were split between technology providing a method for differentiation, an opportunity to work on researching skills, and providing more current content information (See Table 2).

Table 2: *Teacher Perceived Benefits of Technology Use*

Benefit	Number*	Percentage
Increased Student Engagement	38	59%
Increased Student Understanding	15	23%
Increased Instructional Differentiation	6	9%
Increased Exposure to More Current Content Material	3	5%
Increased Opportunities to Use Research and Evaluation Skills	2	3%

*Note. Number of responses based on 64 benefits identified.

The next two questions attempted to compare the reasons for the frequency with which teachers used technology and the reasons for the frequency with which students used technology. Slightly more than half of the time teachers' decisions about technology were determined by its availability or lack of availability rather than its connection or applicability to the content. A quarter of the time the decision was influenced by instructional factors such as an opportunity for differentiation, student interest, or content objectives. The final quarter of the responses were divided between teacher issues such as available time and ease of use and district policies.

Respondents were asked to identify factors impacted the frequency and purposes of students' technology use. Responses were divided between positive and negative factors, with three-fourths (75%) of the respondents identifying negative factors impacting decisions about students' technology usage. Half of the respondent identified concerns about the availability of the equipment. One quarter of the responses were divided between concerns about bandwidth and the available time. The final quarter of the responses focused on instructional concerns such as the learning objectives, doing research, and constructing and presenting information (See Tables 3 and 4). Some barriers only affected teacher or student use, but not both. District concerns only impacted teacher usage and bandwidth was only a concern for student usage.

Table 3: *Factors Impacting Teacher Technology Usage*

Teacher Factors	Number*	Percentage
First Order Concerns		
Total School Constraints	39	67%
Availability of Equipment	36	62%
Instructional Time Schedule	3	5%
Total District Constraint	1	2%
Amount of Instructional Time	1	2%
Second Order Concerns		
Total Instructional Constraints	15	26%
Curricular Content Issues	6	10%
Student Engagement	7	12%
Differentiation of Instruction	2	3%
Total Teacher Knowledge and Skill Constraints	3	3%
Ease of Use	3	3%

*Note. Number of factors based on 58 factors identified.

Table 4: *Factors Impacting Student Technology Usage*

Student Factors	Number*	Percentage
First Order Concerns		
Total School Constraints	36	75%
Availability of Equipment	27	56%
Instructional Time Schedule	5	10%
Bandwidth	4	8%
Second Order Concerns		
Total Instructional Constraints	12	25%
Curricular Content Issues	6	12%
Student Content Generation	3	6%
Student Research	3	6%

*Note. Number of factors based on 48 factors identified.

CONCLUSION

The results indicated that first order barriers, such as technology availability, are still major concerns that impact both student and teacher use. Equipment availability, more than any other factor, seemed to have the greatest impact on whether technology was incorporated into classroom instruction. Teacher knowledge and skill, although a concern, was not the teachers' first consideration. The major reason teachers chose to use technology was because they felt it resulted in increased student engagement. Some of the same factors that impacted whether students used the computer were evident in the decision about whether teachers used technology. Equipment availability, instructional time schedules, and curricular concerns were all concerns that impacted both teacher and student technology usage. Bandwidth, on the other hand, was not an inhibiting factor in teacher use, but it was in student use.

In 2006 Florida established the goal of empowering educators to improve student learning through technology integration (Florida Department of Education, 2006), consequently it was hoped that teachers would identify second order barriers rather than first order barriers. However, seven years after the law was passed, teachers' most frequently identified concern was the availability of technology. This supports Hew and Brush's (2007) findings of the most significant barrier to technology integration is a lack of technology resources. However, the results of this study did not indicate that teacher knowledge was a perceived barrier for this sample of teachers. These results may have been impacted by the sample chosen for this study.

Teachers in this study more frequently viewed technology as a tool for increasing student engagement and understanding, rather than for the higher order skills of research and evaluation thus supporting Hutchinson and Reinking's (2011) findings that teachers are not using technology as frequently for evaluating information. Expanding educators' technology knowledge base might expand technology usage in evaluating curricular content, increasing student engagement, and differentiating instruction. As these issues are addressed, teachers might develop more extensive ways to use technology for research and evaluation.

Instructional concerns, which seem like they should be the driving force in technology usage in education, were not the primary concerns. Instructional concerns were determining factors only about a quarter of the time. After teachers determined that the technology was available, then they considered the instructional content and how technology could be used to enhance instruction.

The open ended format of this research allowed the participants to identify as many areas or factors as they felt were relevant for each question. Some respondents identified only one issue while others identified multiple factors. As long as a factor was identified in the response, it was included in the open and axial coding of the responses. A future study would be necessary to consider the weight or impact each of these factors had on educational planning. Researchers might also want to further examine and prioritize the identified first and second order barriers. Teachers reported the perceived benefits of increased student engagement and understanding, further research would be needed to determine whether these perceived changes can be quantified.

There are some limitations inherent in this study. The majority of the respondents were elementary (K-5) teachers who taught multiple subjects, even though middle and high school teachers were included. Consequently the data might more accurately represent the concerns of elementary teachers rather than middle and high school teachers. In addition, the sample was composed of students who had chosen to enroll in an online graduate program. The study sample might represent a subset of teachers who feel comfortable in the digital environment. Therefore, the results might not be able to be generalized to the larger teaching population. The respondents predominately taught in Florida public and private schools, so these results might represent the concerns of Florida's teachers rather than national concerns. These are all questions that would need to be addressed in other studies. Technology and access to technology are ever changing variables. Future research may want to explore teachers' access to, not only the technology, but also to opportunities for professional development focused on integrating technology into instruction.

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