Technologies on the Horizon: Teachers Respond to the Horizon Report

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Abstract

The purpose of this study was to investigate teachers' beliefs regarding the integration of technologies from the 2011 K-12 edition of the Horizon Report into their local, public school contexts. Teachers read the Horizon Report and then participated in an asynchronous, threaded discussion focusing on technologies they would like to see integrated into their classrooms and technologies they do not see possible in the near term. Qualitative methods were used to analyze the discussion. Findings include the teachers' desire to see mobile technologies integrated into their classrooms, and their belief that there are significant barriers to game-based learning.

Despite ever increasing access to technology in schools, there have not been corresponding increases in meaningful uses of technology in schools. Several researchers (e.g. Belland, 2009; Ertmer, 2006; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Wachira, P., & Keengwe, J., 2011) have proposed that teacher beliefs are one of the reasons behind a lack of technology use in the schools. The idea that teacher beliefs act as barriers to technology use has been persistent in the research literature.

Ertmer, Addison, Lane, Ross, and Woods (1999) identified two types of barriers to technology integration in schools. First-order barriers are extrinsic to teachers, such as lack of resources. Second-order barriers are intrinsic to teachers, such as attitudes and beliefs. The authors conclude that "teachers' beliefs interact with first-order barriers to facilitate or limit teachers' technology use" (p. 67) and they can reduce or amplify the effects of first-order barriers. The idea that the first and second-order barriers are related to each other also was noted by Javeri and Chen (2006) who determined in their work that first-order barriers "manifest into second-order barriers [like beliefs] as teachers get really frustrated with using technology and do not see the pedagogical fit of integrating technology in their classrooms" (p. 157-158). Similarly, Hew and Brush (2007) identified many barriers to technology integration including teacher attitudes and beliefs, concluding that the barriers are related to each other. For example, "teachers' attitudes and beliefs toward using technology are also thought to be affected by their knowledge and skills, and vice-versa" (p. 232). More recently, current research has shown that teacher beliefs about technology are predictors of instructional technology usage (Miranda & Russell, 2012).

It is clear that teachers' beliefs of the value or perceived usefulness of various technologies are important elements to consider when adopting technologies for teaching and learning. The research reported in this paper was conducted with the purpose of understanding teachers' beliefs regarding certain emerging technologies, those listed in the Horizon Report.

The Horizon Report (New Media Consortium, 2011) is an annual report, which forecasts trends in technology use in Education. Different versions of the Horizon Report are pro-

duced each year to address varied educational contexts. The 2011 edition of the Horizon Report for K-12 education was used in the present study, as it was the most current edition at the time the research was conducted that was meaningful to the study participants. It includes predictions for technologies that will be adopted in schools in three categories: one year or less, two to three years, and four to five years. Interested readers can access the report in its entirety online at: *http://www.nmc.org/publications/horizon-report-2011-k-12-edition.* The report used for the present study was constructed through a collaborative effort of the New Media Consortium, the Consortium for School Networking, and the International Society for Technology in Education (New Media Consortium, 2011). The methodology section of the report includes the description of "modified Delphi process" (p. 34) as a label for the methods used. Earlier in the report, the process for identifying the technology areas to highlight is described:

> "To identify these areas, the project has drawn on an ongoing conversation among knowledgeable persons in the fields of business, industry, and education; on published resources, current research, and practice; and on the expertise of both the NMC community and the communities of the members of the NMC Horizon Project's K-12 advisory board, an international body of experts in education, technology, and other fields.
>
> The advisory board, chosen to broadly represent a range of perspectives in K-12 education, engaged in a discussion around a set of research questions intended to surface significant trends and challenges and to identify a wide array of potential technologies for the report." (New Media Consortium, 2011, p. 3).

For more details about the creation of the report, the New Media Consortium hosts a wiki space (e.g. http://k12-2011.wiki.nmc.org/) for each edition of the report. The wiki space includes a timeline, which displays key points in the creation of the report; a list of the advisory board members who construct the report; the questions used to generate discussions related to the creation of the report, and the discussions; and many other artifacts related to the process of creating the report. The present study was conducted to investigate the questions:

> Question 1: Which technology in the one year or less OR two to three year categories of the Horizon Report would teachers most like to see used in their schools?
>
> Question 2: Which technology in the one year or less OR two to three year categories of the Horizon Report do teachers perceive as least likely to be used in their schools?

The categories of *one year or less* and *two to three years* were selected as delimitations for the present study because it was believed that the technologies in those categories were sufficiently mature for the participants to consider as realistic possibilities in Education. The 2011 edition of the Horizon Report included *cloud computing* and *mobiles* in their one-year or less category; *game-based learning,* and *open content* in the two to three years category; and *learning analytics* and *personal learning environments* in the four to five year category. Discussions, definitions, and examples are provided for each of these technologies in the report.

Methods

This study was conducted as what Merriam (1998) describes as a *basic qualitative study* where the researchers were interested in understanding the perspectives and beliefs of the participants, but there was no focus on culture, building theory, or conducting an intensive case study. The focus was on identifying patterns and common themes in the data collected. (p. 11)

Participants

Participants (8 male, 12 female) in this study were teachers living in Georgia who were enrolled during the spring 2012 semester in an online, graduate-level Instructional Technology course at a public university in the southeastern United States. Twenty-three students elected to participate in the study, however, only 20 were used in the data analysis. Two participants were removed because they worked at the college level and the questions being investigated required a K-12 school context. A third participant provided incomplete responses to the discussion prompts and was removed from data analysis. Demographic information was compiled from participant responses in the discussion. Some participants provided more information than others, so full demographic information is not available for all variables. The participants worked in a broad range of settings. Students reporting their place of work indicated elementary school (n = 7), middle school (n = 3), high school (n = 4), and charter school (n

= 1). Nine students reportedly worked in rural schools; eight students worked in urban schools. A wide range of different content areas were represented, including mathematics (n = 3), English (n = 2), social studies (n = 1), science (n = 1), technology (n = 2), computer science (n = 1), business (n = 1), and special education (n = 2). Nine of the participants reported that they were married, and seven reported being parents.

Data Sources

Asynchronous, threaded discussions were utilized in the course and are delivered via the institutionally supported learning management system. The present study was explained to each member of the class as required by the institution's human subjects review board, and each member of the class agreed to be included in the study. All the participants engaged in a required, beginning-of-semester introduction discussion, in which they were simply asked to introduce themselves to their classmates. The introduction discussion, like all of the discussions in the class, took place asynchronously in a threaded discussion forum in the University's institutionally supported learning management system. Some students chose to include multimedia presentations with their introductions, but the majority of participants provided text-based introductions. These introductions were used to compile the participant description provided in this report. Additionally, as part of the course, the participants engaged in an online discussion about aspects of the New Media Consortium's 2011 K-12 version of the Horizon Report (New Media Consortium, 2011). Specifically, participants were asked to do the following:

> Read the most current Horizon Report that makes sense for your professional context. Post your answers to the following questions in the *Horizon Report* discussion forum.
>
> a. Which technology in the one-year or less OR two to three year categories of the Horizon Report would you most like to see used in your school? Why?
>
> b. Which technology in the one-year or less OR two to three year categories of the Horizon Report do you see least likely to be used in your school? Why? That is, what barriers exist to integrating this technology?

Notes – You may not cite lack of financial resources as a reason that a technology will not be adopted. This reason would simply be too easy in our current economic climate. Assume for the purposes of this assignment that your school could afford the technologies listed, at least on small scale. Also, organize your responses so it is easy to see how you answered the three questions for this assignment.

The participants' responses to these prompts were used as the data sources to answer the research questions. Initial responses to a) were used as the data sources for question 1 and initial responses to b) were used as the data sources for question 2. The participants were instructed that financial constraints would not be accepted as reasons for non-adoption of the technologies, due to the economic climate at the time the study was conducted. The researchers believed that this restriction would eliminate an obvious and non-interesting response from the participants.

Analysis

Miles and Huberman's (1994) overall strategy of data reduction; data display; conclusion drawing and verification for qualitative analysis was utilized for this study. Specifically, content analysis, described by Merriam (2009) as "the frequency and variety of messages, the number of times a certain phrase or speech pattern is used" (p. 205) was used for data reduction. The researchers independently evaluated the participants' responses to writing prompt a) to address question 1 and generated a list of the technologies most desired to be adopted (see Table 1). Similarly, the researchers employed content analysis to the data collected from writing prompt b, to address question 2 and generated Table 2 showing the frequencies of the technologies identified as least likely to be adopted. Once the lists were generated, the researches reexamined the discussion entries to determine reasons why the participants had identified the various technologies. Reasons were coded and tallied independently by the researchers, and representative quotes from the participants themselves were selected that helped illuminate the beliefs and experiences of the participants. Discussion between the researchers was used to clarify and finalize the participants' reasons. The researchers' independent analysis, and resulting consensus, increases the reliability of the results.

Findings and Discussion

The most desired technology was *mobiles.* Mobiles are "a category that defies long-term definitions" (New Media Consortium, 2011, p. 6), but the Horizon Report includes smartphones and tablet computers in its discussion of mobiles. The technology perceived

Table 1. Frequency of choices of desired technologies

Technology	Number of Participants Identifying	Time to adoption
Cloud computing	5 (25%)	1 year or less
Mobiles	11 (55%)	1 year or less
Game-based learning	3 (15%)	2 to 3 years
Open content	1 (5%)	2 to 3 years

Table 2. Frequency of choices of technologies least likely to be adopted*

Technology	Number of Participants Identifying	Time to adoption
Cloud computing	2 (10%)	1 year or less
Mobiles	5 (25%)	1 year or less
Game-based learning	10 (50%)	2 to 3 years
Open content	2 (10%)	2 to 3 years

Note. *The answer of one participant was not applicable to the question.

as least likely to be adopted in schools was *game-based learning*. The Horizon Report discusses digital games for learning with examples from education publishers, commercial games, games for mobile devices, online games, and games for specific game consoles. The frequency counts observed for both desired and least likely to be adopted technologies indicate a great deal of agreement among the participants. Next, the reasons for their selections will be examined.

Why they chose the most desired technology

Participants gave a wide variety of reasons for choosing mobiles as the technology they would most like to see used in their schools. Several participants agreed that an advantage of mobile devices is that they are engaging. Mobiles would "… engage my young learners during reading workstation time…Students love them, and that would make the process of learning much more fun for the students" according to a first grade teacher in a rural elementary school. Students are enthusiastic about the use of technology. "The students are already very comfortable with the use of mobile technologies for learning," said a male teacher who works in a small, rural middle school. "It would be a great idea to take advantage of [students'] enthusiasm for technology use and find great ways to integrate [mobiles] into the classroom," wrote one female teacher.

Many students own mobile devices and know how to use them. Participants reported that students need to know how to use mobile devices to prepare them "for a future of ever-evolving hardware." "Students must become more and more familiar with utilizing mobile devices, accessing the Internet and creating authentic products," was the response of one female elementary school teacher. There are many functions of mobile devices that students can use in educational settings. "Having mobiles would allow students to type up a short story or paper," said one elementary school computer lab teacher. According to a female teacher from a rural elementary school, "students can better express themselves creatively with advanced video, audio, and imaging resources." "Students have the capability to look up or research any topic of their choice simply by using whatever mobile at their disposal." wrote a male teacher at a rural school. He also said that mobiles are a "quick and easy way to get students engaged and on board with learning." Students can even use mobile devices to complete projects outside of school.

Participants identified many perceived educational benefits of using mobile devices

across all subjects in school. Mobile devices were noted as capable of making learning fun for the students, and allowing easy access to remediation software. Teachers believed that mobile devices could be used to increase the amount of interactivity in the classroom as well as reach students with special needs. Mobile devices were cited as possibly eliminating expenses of hard-copy textbooks and increasing student access to textbooks as e-books.

Several participants commented on the capability of mobiles to allow students to take "education" with them "anywhere". A male teacher at an urban elementary school said that mobiles "have so much power and potential, which makes the possibilities for their use literally endless. The wide variety of educational [applications] make them an excellent teaching and learning tool." Several other teachers also listed the variety of educational applications as a reason they would like to see mobiles used in their schools. A special education teacher of an elementary school gave another reason for using mobiles in school. "Technology is not going away. It is important for students to utilize these technological resources to excel their learning." The convenience of e-books, a variety of other tools, access to information, and social networking adds to the advantages. The comments of the teachers are summarized nicely with text from the Horizon Report: "The portability of mobile devices and their ability to connect to the Internet almost anywhere makes them ideal as a store of reference materials and learning experiences, as well as general-use tools for fieldwork, where they can be used to record observations via voice, text, or multimedia, and access reference sources in real time" (New Media Consortium, 2011, p. 15).

Why they chose the technology least likely to be adopted

Participants gave a variety of reasons for choosing game-based learning as the technology that is least likely to be used in their schools. Many of the reasons given involved school or district policies and school administrators. Others were due to teacher and parent beliefs.

Several of the reasons given for listing game-based learning as least likely to be used in schools are based on the beliefs and attitudes of school administrators. "Gaming has a negative connotation associated with it from the educator's point of view," reported a female teacher of a large urban high school. Participants believed that school administrators have negative attitudes toward game-based learning. One participant commented that school administrators might not think game-based learning is appropriate, or view it as effective. An elementary school teacher commented, "our administration does not agree with playing games in the classroom after kindergarten." General comments about issues related to school administrations being resistant to game-based learning were common. Parents and teachers also have negative opinions about game-based learning. According to a female teacher of an urban elementary school, "many parents and even teachers believe that students cannot learn through play, and [play] is a waste of time." Certain teachers cannot accept game-based learning as an instructional method; they believe that it is not an efficient way to present information. A female teacher of a rural elementary school does not think that "teachers are at a point where they can accept game-based learning and implement it in an efficient manner." Another female teacher of a rural elementary school agrees with her school's point of view that game-based learning will "conflict with instructional time and learning environments." She also said, "Some students these days just seem to get so into the games they forget what they are learning about or just press buttons, which does not test their actual knowledge of a concept." Teachers and administrators are concerned that the competition and fun of the games will interfere with students' education.

Teachers also commented that there is a lack of prepared material that is relevant to the content, which utilizes games in a meaningful way. Additionally, a male teacher of a rural middle school commented, "It is impossible for teachers to generate [or] create the material for such technologies as many don't even know such tools exist. Furthermore, the readiness of our staff to make efficient use of such technologies is severely lacking." The production quality of games also was criticized. One teacher commented, "gaming designers are spending more money on war simulations as opposed to learning simulations. The [educational] games that are available lack the realism and attention to detail that is found in consumer games."

Urban vs. Rural Beliefs

Because the participants were nearly evenly divided in terms of urban vs. rural schools, the researchers were curious if there would be a difference in teachers' perceptions between these contexts. The small number of responses makes a statistical interpretation suspect, but

Table 3: Technology teachers would most like to see used in their schools: Rural vs. Urban schools

Technology	Rural	Urban
Cloud Computing	2	2
Mobiles	6	4
Game-based Learning	1	2
Open Content	0	0

Table 4: Technology that is least likely to be used in their schools: Rural vs. Urban schools

Technology	Rural	Urban
Cloud Computing	0	1
Mobiles	1	2
Game-based Learning	6	4
Open Content	1	1

the evidence displayed in Tables 3 and 4 does not show an obvious difference between rural and urban schools.

Conclusions and limitations

The research conducted for this study has provided information regarding teacher beliefs about the adoption of emerging technologies in K-12 public schools. Understanding these beliefs can be an important step in planning for the successful use of technologies in the classroom. Based on the findings of this study, it appears as though teachers are interested in leveraging student access to, and interest in, mobile devices in their classrooms. Reasons like *student excitement* and *preparing students for the future* provided in the present study echo earlier findings (Ertmer, Addison, Lane, Ross, and Woods, 1999). The reasons given by the teachers for wanting to integrate mobile devices indicate that they may need significant professional development in the area of mobile learning in order to fully exploit the possibility for meaningful uses of the devices' mobile aspects. Their examples centered on classroom uses of the devices and bring to mind visions of students sitting at tables or desks accessing the Internet, using apps, or reading electronic copies of textbooks. Mobile devices allow for much more innovative learning experiences than those described by the participants. Researchers interested in studying the integration of mobile devices in schools may find teachers interested in cooperating in such endeavors, but the teachers may need assistance understanding that there is more to mobile learning than simply having portable wireless devices accessible to students.

Anyone with the goal of integrating game-based learning in public schools may find the information provided by this research helpful in their planning. Participants expressed an interest in game-based learning, but school administrators and parents, as well as some educators, are perceived to hold negative beliefs and attitudes regarding the use of games in education. This is in agreement with Rice (2007) who found that negative perceptions for video games in learning are held by educators and that many administrators are wary of video games in learning because of the violence often associated with them.

Hew and Brush (2007) contend that the task of facilitating change in beliefs and attitudes toward technologies lies with principals and other school leaders. In the case of game-based learning, it appears as though the teachers may be ahead of administrators and parents. Charsky and Mims (2008) anticipated these issues. They specified the importance of securing administrative support and buy-in from parents and colleagues before

implementing video games in public school classrooms. It appears as though this remains to be an important element for the implementation of games into public schools.

This research study is not without limitations. The study was conducted in a relatively short period of time with a group of teachers who were all located in one southeastern U.S. state. Their responses were obviously influenced by what they had read in the Horizon Report (New Media Consortium, 2011) for the study, as several of their comments and examples were similar to those given in the report. Note that mobiles is in the 1 year or less category and game-based is in the 2 to 3 year window so perhaps teachers were better able to imagine the nearer term technologies as possible. Future research should consider these factors as possibly influential to the findings reported for this study. The observation that teachers in rural and urban schools may have similar beliefs about these emerging technologies is interesting and may warrant additional investigation.

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