The Only Thing We Have to Fear is… 120 Characters

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Abstract

Cell phones have been banned in 69% of today's classrooms (CommonSense, 2010). Reasons for the banning of cell phones may seem obvious—kids will misuse them to cheat, use textese in place of Standard English, cyberbully, and sexting (Brady & Conn, 2006; Johnson, 2004; Obringer & Coffey, 2007). These fears have disregarded the fact that today's cell phones are inexpensive, mobile computing devices with a number of applications (assessments, digital images, podcasting, and internet access) that could be beneficial in the classroom. The bonus to these applications found on cell phones is that the majority of teenagers already own one and are efficient in their use. The question is, should the fears of the misuse of cell phones and the technology they provide prevent teachers from tapping into the many opportunities and benefits that cell phone use in the classroom might provide? This paper explores the current research to refute the claim that cell phones are responsible for aberrant behaviors and to explore the potential instructional benefits of cell phones in the classroom.

As former classroom teachers, we knew one thing our students would bring to class every day. Was it their books? No. A pen and paper? No. Homework assignments? No. The one item our students always had with them was their cell phone. In fact, 84% of teens between the ages of 15-18 have a cell phone, and 85% of them use their cells for text messaging (YouthBeat, 2009). On average, teens send 2,272 texts per month (Hafner, 2009) and 70% of teens use texting for schoolwork (Lenhart, Ling, Campbell, & Purcell, 2010). Based on the classroom observations of the authors, commentary in the media and a review of literature, cell phone use by teenagers in school has created a number of concerns for educators: the use of textease (an abbreviated form of English usually used during texting) (Brouin & Davis, 2009; Lee, 2002; Lenhart, Arafef, Smith, &, Macgill, 2008), cheating (CommonSense, 2010; Strom & Strom, 2007), cyberbullying (Beran & Li, 2005; Feinberg & Robey, 2008; Long, 2008; Obringer & Coffey, 2007) and sexting (a portmanteau of the term sex and texting is the act of sending sexually explicit texts or pictures primarily via cell phones (Boucek, 2009; Carroll, 2004; Soronen, Vitale, & Haase, 2010). As a result of these concerns about the potential misuses of cell phones, 69% percent of American high schools now have bans on their use or possession on school grounds (CommonSense, 2010). Although these fears are not completely without merit, they are largely based on anecdotal evidence and ignore the fact that while cell phones may make it easier for students to engage in certain inappropriate behaviors, they are not the cause of these behaviors. Furthermore, these fears have blinded school stakeholders to the instructional benefits of utiliz-

ing cell phones in the classroom. The purpose of this paper is to: (a) explore the veracity of each of these fears as well as the culpability of cell phones in these aberrant behaviors and (b) present the instructional benefits to be gained by allowing cell phones in the classroom.

Textese

"Textese" is a term used to describe the abbreviated language and slang used when sending text messages (traditionally text only allowed 120 characters per message). Many people, educators included, believe that textese is destroying our language and our children's ability to write. Along with having no foundation in fact and being largely the product of the media, this fear of adulteration is nothing new. Teachers often fear anything written or spoken that does not use Standard English. These fears are illustrated in the fight over Ebonics or Black English (Rickford, 1999, 2000). This same argument can be used when discussing the use of textease. Linguist David Crystal (2008) acknowledges this in his book *Txtng: The Gr8 Db8* (2008):

> If I had a pound for every time I have heard of someone predicting a language disaster because of a new technological development, I should be a very rich man. My bank balance would have started to grow with the arrival in the Middle Ages of printing, thought by many to be the invention of the devil because it would put all kinds of false opinions into people's minds. It would have increase with the arrival of the telegraph, telephone, and broadcasting, each of which generated short-lived fears that the fabric of society was under threat (p. 9).

Orthographically speaking, there is also nothing novel about texting. Textese makes use of a number of text orthography features: logograms, pictograms, rebuses, and initialism, (omitted letters and nonstandard spellings). However, none of these are new to our use of the written word. Crystal relates several examples of orthography used before texting was available "XO" at the end of a letter is a logogram for hug and kiss and the term MIA (missing in action) is initialism (Crystal, 2008).

Students, like adults, are able to "code switch" between modes of communication (Plester, Wood, & Bell, 2008). Code switching involves the ability to make transitions between different means of communication based on situational needs. Students consciously use one "register" of language when interacting with their peers but another when interacting with their grandparents. Students code switch daily when they switch from slang used in the hallway to language more appropriate or acceptable in the classroom. Speech and language therapist Veenal Raval (Ward, 2004) notes:

> The fear that has been put across in the media is that children don't understand the need to code switch-that is, switch between Standard English grammar for an exam or essay and what is acceptable when you are communicating on a social level. In fact, they are capable of that switch, just as bi- or tri-lingual children might speak English at school and mother or father tongue at home (p. 3).

Textese is not harmful to students' ability to write. In fact, what research has been done in this area appears to support the exact opposite. Researchers at Coventry University in London studied emerging writers, ages 10 to 12, to ascertain the effects of texting on their writing development. They found that the use of texting did NOT negatively affect students' writing skills. In fact, data supported exactly the opposite conclusion: students who texted more often wrote more and had better writing and spelling skills than their peers who texted less (Plester et al., 2008). Plester makes a point worth remembering when she states, "The more exposure you have to the written word the more literate you become, and we tend to get better at things that we do for fun" (BBC News, 2009).

To summarize, textese or forms thereof have been a part of our everyday speech and writing for years. Students and adults code switch between textese and other non-Standard English regularly with no seeming detriment. While some educators and media have supported misinformation about the negative effects of texting, research does not support such conclusions.

Cheating

Another trepidation expressed by administrators and teachers concerning using cell phones at school is the problem of cheating. In fact, a recent study conducted by Common-Sense Media (2010) found that one-third of high school students admitted using their cell phones to cheat. While alarming, these numbers must be put in perspective. The practice of cheating is not a result of the invention of the cell phone; rather it can be traced in history through thousands of years (Bushway & Nash, 1977). In 1980,

before mobile phones, 75% of students reported cheating in school (Baird, 1980). Twenty-five years later, 74% of students reported cheating in school (Pickett & Thomas, 2006). A 2008 study by the Josephson Institute found that 62% of students reporting copying another students' homework; 56% lied about something significant to a parent more than twice a year, and 30% admitted stealing from a store within the past year. Research indicates that students cheat due to "an erosion of ethics, self-centeredness, not being held responsible for their actions, and pressure from high-stakes testing and parents to perform regardless of the means—none of which have to do with technology or mobile phones" (Strom & Strom, 2007, p. 42). School administrations and teachers would benefit from the recommendations of Bushway and Nash by focusing less on pointing the finger at the causes of cheating. Instead, they should educate students about the immorality of cheating, its effects on the cheaters, and the implications for other students in the class so as to discourage and prevent students from cheating. With that said, cheating has been a part of school for a very long time. Removing the opportunity to use cell phones will hardly fix this issue. A better resolution would be for students to check in their phones at the beginning of a testing period and retrieve them when they leave the room.

Cyberbullying

The act of bullying has been a part of schooling for time untold, however, bullies have found a new tool to demean and hurt fellow students. A recent study by the Pew Internet and American Life Project found that 26% of teens have been harassed through their mobile phone either by calls or text messages (Lenhart et al., 2010). However, as with cheating, bullying predates mobile phones. Cyberbullying is the latest technological incarnation of this harmful behavior. Cyberbullying, like traditional bullying, is about power and often times gaining social status (Holladay, 2010). Banning cell phones is not going to make students stop bullying. Rather, teachers, students, and parents have to be educated about bullying in order to debunk misperceptions about digital behavior, build empathy and understanding, teach online safety skills, and equip young people with strategies to reject digital abuse in their lives (Holladay, 2010).

Cyberbullying is more pervasive because the bully can reach a large number of people at once. It also may be more harmful because the bully does not have to be physically present while the person is being bullied. Students bullied via cyberspace are unable to escape the bully without giving up the use of a cell phone. Cyberbullying can also involve the next concern about the use of cell phones, the practice of sexting.

Sexting

As David Crystal notes in, *Txtng: The Gr8 Db8* (2008), much of the fear associated with texting and cell phones is a creation of the media. Case in point is sexting. As many as one in five teens have reported sending a nude or semi-nude photo of themselves to someone in a text message and 22% report having received such an image from someone else (National Campaign to Prevent Teen and Unplanned Pregnancy). While this is an alarming statistic; teenagers have been passing notes about sex since the introduction of slate tablets. There is no empirical evidence to support the claim that cell phones increase incidents of students talking or writing about sex. Nor is there anything inherent in the technology that supports aberrant behavior. Rather, just as with cheating, such inappropriate behavior is a result of a lack of guidance and mentoring on the part of adults regarding the proper use of technologies like cell phones. Jim Hirsch, an associate superintendent in Texas, believes that school staff, school board members, and parents must, "…shift their thinking from the concept that schools must 'protect' students by restricting access to commonly used devices to the idea that schools have to 'educate' students to use these devices and tools responsibly while in and out of school" (2005, p. 1).

Teaching technology is analogous to teaching driver's education in schools. Just as the driver's education instructor teaches students how to properly drive a vehicle, educators should be teaching students the appropriate use of technologies if for no other reason than they are, "learning to do something very important that carries some inherent and significant personal and social dangers" (Hargadon, 2008, p. 2). An alarming number of students are injured or killed in traffic accidents each year, but no one blames the car for these tragedies. It is accepted that driver error and not the car itself is at fault. The same is true of cell phones used for inappropriate activity. By teaching students about the ethical and legal use of cell phones, teachers also address state and National Technology Standards for Teachers that require them to demonstrate the ethical and legal use of technology (ISTE, 2008).

The fear of sexting extends beyond student use. School stakeholders are also afraid

of teachers using cell phones for inappropriate communication with students. To assuage these fears, some states, most recently Virginia and Louisiana have banned electronic communication, including texting, between teachers and students (LaMonte, 2009; Watters, 2011). It should be pointed out again that there is no empirical evidence to suggest that cell phones or texting has increased the number of cases of inappropriate teacher to student communication. As Arthur Graves, Chairman of the Secondary Principals' Council, points out, "the rise of text messages and emails have made teacher---student boundaries 'a little easier to cross,'" but it is the, "content of the message that counts, not the mode of the message" (Woulfe, 2007, p. 2). Technologies like texting have the potential to be invasive, but so does email or the landline phones of the past fifty years. Teachers who follow the proper guidelines can use any technology in a professional manner (Woulfe, 2007).

The question remains with so much negative commentary about the use of cell phones in schools what types of instructional benefits can these phones provide the classroom teacher?

Instructional Benefits

The ban on cell phones ultimately hurts students by denying them access to inexpensive computing. Today's smart phones are portable, pocket-sized computers that have a number of features with the potential to support instructional practices. For example, cell phones can be used in the classroom for content creation (Hartnell-Young & Vetere 2008), student-centered learning, collaboration (Corbeil & Valdes-Corbeil, 2007), authentic learning (Brown & Duguid, 1996), and differentiation of instruction (Kukulska-Hulme, 2007). Additionally, cell phones can be used for assessment and reflection (Markett, Sanchez, Weber, & Tangney, 2006). One of the most important instructional benefits provided by the portability of cell phones is their support of anywhere/anytime access to course material. Cell phones provide interaction and communication with teachers and peers which promotes a more active and continuous learning environment, facilitates the building of a learning community, provides feedback and increases student motivation (Markett et al., 2006). Students have reported that cell phones allow them to multitask (Lu, 2008; Yerushalmy & Ben-Zaken, 2004) by giving them the ability to access course material, conduct research via the Internet, and communicate with peers and teachers in what could otherwise be periods of dead time—for example while they are rid-ing on the bus, waiting to be picked up from school, or at an appointment (Kolb, 2011; Motiwalla, 2007; Yengina, Karahoca, Karahoca, & Uzunboyla, 2011). The specific cell phone tools that support these instructional benefits are a ddressed in the Appendix.

Texting

Texts can be used to support the three types of participant interaction: student to student, student to teacher, student to content (Moore, 1989) as well as teacher/school to parent communication. Students are already using their cell phones to text one another about schoolwork. In fact, 76% of girls and 64% of boys text about school work (Lenhart, Ling, Campbell, & Purcell, 2010). Students use text messages informally to communicate and collaborate on school assignments. Students text classmates to inquire about and collaborate on homework assignments; however, teachers can use them for more formal classroom assignments.

The anywhere/anytime capabilities provided by cell phones allows teachers to send texts to students (individually or in collaborative groups) to provide them with data from any discipline (math, science, language arts, social studies) for real time analysis and response (Prensky, 2005). Students can receive additional instruction and/or practice problems for any content area. For example, Nick Schultz, a high school Latin teacher sent students text messages in Latin. Student's responses were expected to be in Latin (Thomas & Orthober, 2011). There is a growing body of research to support the effectiveness of using text messaging to teach language learning. Teachers and administrators can also use texts to send students reminders about homework, upcoming tests, or school related information (Bull & McCormick, 2011; Stone, 2004; Thomas & Orthober, 2011). In addition to texts, students and teachers can use their cell phones to access email and/or social networks for collaborative use by students on work outside of class.

The use of cell phones and texting can also be used for assessing students. Texting can be used for these important classroom assessments: pop quizzes, spelling and math tests, and to poll student responses (Prensky, 2005). Whattananarong (2006) found that cell phones can be an effective means of testing student performance; he found that students who took tests by cell phone performed comparably with students who did so by conventional methods. Companies like The Princeton Review and Kaplan already offer SMS based test-preparation questions for the Scholastic Achievement Test and other standardized

test that can be sent to users (Hartnell-Young & Vetere, 2008). The site Poll Everywhere (polleverywhere.com) allows cell phones to be used in the same manner as student response systems, (e.g. clickers) for polling student responses. Classroom response systems are beneficial for assessment, can enrich classroom discussion and provide anonymous, fast response collection (Roschelle, 2004; Naismith, Lonsdale, Vavoula, & Sharples, 2004). They have been shown to improve student interaction, engagement and attention (Draper & Brown, 2004; Hinde & Hunt, 2006) and improve learning performance (El-Rady, 2006). Users of Poll Everywhere can create free, multiple choice assessments that can be projected on a screen; students respond by typing in a number using their texting feature. Results are instantaneously displayed in a graph or chart as they are entered by students, providing them with instantaneous feedback. For example, Lisa Kolb (2011) describes 7th graders using Poll Everywhere in a Social Studies classroom. As students enter the classroom, the teacher has posted a brainstorming question asking students what they believe to be the most important cause of the Civil War on the whiteboard. Students are to text their answer to the questions as soon as they enter the class. Students are able to watch the changing results displayed in a bar graph on the whiteboard. The teacher then asks students to send another text message explaining their reasons for their choice. Again, students are able to view all of the students' responses, which provides for them an opportunity to reflect on their own reasoning. The anonymous nature of the texts allows students to feel comfortable giving honest opinions (Kolb, 2011; Banks, 2006; Durbin & Durbin, 2006). In addition to classroom uses, Poll Everywhere can be used in faculty and parent assemblies to receive feedback.

Another means of assessment afforded by texting is short-answer problems. Students can text answers to short-answer problems to their teacher, a significant improvement over clickers because it allows open-ended questioning (Lindquist, et al, 2007; Pitler, Hubbell, Kuhn, & Malenoski, 2007). For example, Inez Brown, had students use the texting feature on their phones to summarize and analyze sections of *Richard III* to help them better understand the play (Benard, 2008). Michelle Dawson had her high school juniors use texting to transcribe lines taken from *Macbeth* into text language. In other classes, she has students compose poetry using SMS ("Teachers", 2004). Mrs. Dawson reports that using texting as a classroom medium has captured the students' interest and inspired them to do

better work. Furthermore, the ability to effectively summarize assists students in identifying the important features of what they are learning. This is especially true when the teacher uses a frame of reference (Marzano, Pickering, & Pollock, 2001).

Texting can also be used by teachers and schools to communicate with parents. Research has demonstrated that providing students and parents with regular information about classwork leads to a higher assignment completion rate (Sui-Chu & Willms, 1996). Research emphasizes the benefits of communication between school and home as well as its direct relationship to student achievement in the classroom (Henderson & Mapp, 2002). Therefore, teachers and school administrators can use text messaging to communicate with parents regarding a variety of school related messages like class assignments, attendance and updated school information.

Finally, the asynchronous nature of texting allows students time for reflection. The reflective characteristic of texting is supported by the archival feature that permits students to follow the interaction posted during texting (Markett et al.). Students may think of a comment or point to add to a previous classroom discussion after leaving school, and texting allows them to add this comment to the discussion. Similarly, some students may not feel comfortable making comments in the classroom. This could be due to certain students tending to dominate classroom discussion or because a student is shy. Again, texting provides a place for these students to participate in the classroom discussion (Davis, 2003; Markett et al. 2006). While texting is an excellent tool for classroom use, cell phones have additional instructional features.

Digital Images

Most cell phones have a digital camera. In fact, 83% of teens report having taken a picture with their cell phone (Lenhart, Ling, Campbell, & Purcell, 2010). Used in the classroom, digital photography can create opportunities for engagement and authentic learning (McAnear, 2004). Student use of digital cameras also allows them to "capture images from their vantage point, participate in the construction of knowledge, and learn how diverse perspectives can be shaped" (Roblyer & Doering, 2009, p. 351). Bull and Thompson (2004) identify a number of classroom applications for digital cameras and images: (a) the collection of data, scientific visualization, communication in science, (b) facilitation of reading, writing, and visual com-

munication in language arts, (c) mathematical analyses, transformations, and providing a context for problem solving in mathematics, and (d) as a tool for inquiry in social studies.

The digital cameras on cell phones can be used to facilitate reading, writing, and visual communication through digital storytelling. Digital storytelling is a "form of short narrative, usually a personal narrative told in the first person, presented as a short movie for display on a television or computer monitor or projected onto a screen" (Davis, 2004, p. 1). Digital storytelling facilitates students' ability to compare and contrast the past and present, make students aware of diverse perspectives, and develop skills in analysis and critical thinking (Berson, 2004; Berson & Berson, 2003; Lee, 2008; Lee & Clark, 2004). Furthermore, digital storytelling helps students develop 21st century literacies—digital, global, technology, visual and information (Brown, et al., 2006). For example, Greenhut and Jones (2010) used student's mobile phones to create an engaging, authentic learning opportunity while visiting the National Archives with 90 students in their 7th grade U.S. History classes. The activity was part of a unit on the Constitution. Working collaboratively in teams, students were charged with analyzing and identifying documents in the archive that demonstrated the Constitution "in action". Students were to use the digital camera on their cell phones to photograph documents they identified. Next, they would use cell phones to call a webservice, PhoneCasting (other similar webservices include Gcast, VoiceThread, Yodio), that converted their phone messages about the photographs into podcasts. Back in class, students edited the images and podcasts into a digital story using moviemaking/storytelling software like Microsoft MovieMaker, iMovie or Photostory 3. Throughout the process, their teachers noted that the students demonstrated higher-order thinking skills such as synthesis and evaluation while working diligently and independently to create their digital stories that demonstrated the students' personal experience with the archive as well as their deepened understanding of the Constitution.

The use of digital cameras is not limited to the secondary classroom. Elementary students can use the digital cameras on a cell phone to take pictures while on a field trip (e.g., at the zoo), of family members to create a family tree, or items that start with a certain letter, or of shapes (triangles, squares, circles) at school or home. Images can be used to enhance multimedia projects/presentations (PowerPoint, Prezi) or placed online on class/personal weblogs, wikis, websites or Web 2.0 applications like Picassa or Flickr.

Finally, teachers can create QR codes with instructional information attached. The websites Kaywa and BeQRious allow teachers to create QR codes with content (e.g., email, text message, YouTube video) attached to them. The QR codes can be printed off and copied onto a handout or posted in the classroom. Students can then scan the QR code using a QR code reader app on their cell phones. Once the students scan the QR code, the teacher-attached content is immediately sent to their phone. Like other cell phone applications, the use of the QR code would ensure anytime, anywhere access to course work. No more student excuses of losing an assignment or of leaving assignments at home or school.

Podcasting

Cell phones allow users to go beyond static images and capture dynamic audio and video recordings—podcasts. Podcast are audio or video files, usually in an mp3 format that can be downloaded for broadcast/listening on either a computer or more often on an mp3 player an iPod (thus the name podcast), or a cell phone.

Research has demonstrated that student-produced podcasts can increase motivation and higher-order thinking as well as improve student writing and listening skill (Dlott, 2007; Halderson, 2006). Anderson (2005) notes that podcasts increase students' sense of ownership and meaningfulness in their learning. Like other cell phone tools, podcasting provide students with anytime/anywhere access to class content (Bongey, Cizadlo, & Kalnback, 2006; Gay, Price, & Searle, 2006; Rose & Rosin, 2006). Students can use these tools to record their teachers' lectures or for classroom projects. For example, students could record themselves practicing the proper pronunciations of words for a foreign language course. Likewise, students could find community members who lived during the civil rights era and interview them for a social studies project. As demonstrated in the example above, these recordings can be turned into podcasts immediately using online programs like Gcast or PhoneCasting or later using free Open Source software such as Audacity. Finished recordings can be used to create digital stories, create/enhance multimedia productions, or posted on class or personal wikis, weblogs or webpages.

Teachers can use the same tools to create podcasts of lectures, reviews, classroom discussions, and demonstrations. Supplemental materials such as video clips, interviews, and news

can also be podcasts. Podcasts can be placed on-line on the class wiki or weblog for students to easily access. Students can download this content to their cell phones to listen to when and where they want. They can repeatedly access content as well as control the speed and pace of the verbal and visual stimuli being offered thus allowing them to adequately process the content before more information is presented and lost (Wall et al., 2010).

Podcasts also differentiate instruction by appealing to audio or visual learners (Gatewood 2008; (Smaldino, Russell, Heinich, & Molenda, 2005) as well as students with language or cognitive special needs (Molina, 2006). For example, teachers at two elementary schools used podcasts to differentiate instruction for children with diagnosed learning disabilities in their special education classes (McClain, Boyle, Franks, Komoff, & Kratcoski, 2007). Students at both schools worked collaboratively to create podcats for a weather unit. Teacher- and student-generated podcasts were used to familiarze students with key terms and concepts prior to the introduction of material and to extend and enrich individualized learning. The two teachers found the use of podcasts improved student comprehension and retention. Furthermore, teachers observed improved student engagement, motivation, and self-esteem during the podcasting project.

Internet Access

Using the Internet is second nature to today's teens and provides a critical link to vast sources of information. The millennial generation is most likely to access the Internet wirelessly with a laptop or mobile phone (Zickuhr, 2010) providing them with anytime access. The Internet is an excellent instructional tool for supporting communication, collaboration, the collection and analysis of information, and individual and cooperative problem solving (Harris, 2002). Allowing students to access the Internet by way of their cell phones also helps bridge the digital divide since students in low socio-economic and minority groups primarily access the Internet on their cell phones (Lenhart et al.). The Internet can be used to access any number of tools for classroom use.

Students' can access the Internet on their cell phone to use something as simple as email. Thornton and Houser (2005) emailed their Japanese students English vocabulary to access from their cell phones. As is the case with minority and lower socio-economic groups in the U.S., Japanese students more often access the Internet from their cell phones. Thornton and Houser found that students who received vocabulary via email scored higher on assessments than students who did not.

Educational Applications (Apps) for mobile phones can be downloaded for use by students inside and outside of the classroom. It is easy to become enamored of the vast array of applications categorized as "educational"; however, educators must be careful when selecting applications to ensure that they have a demonstrated instructional value.

Math4Mobile, a site developed by the Institute for Alternatives in Education at the University of Haifa, has five free math applications for download and use on mobile phones:

- **Graph2Go** is a special-purpose graphing calculator that operates for given sets of function expressions;
- **Solve2Go** supports solving equations and inequalities by means of conjectures based on visual thinking;
- **Quad2Go** is a handy tool for learning about quadrilaterals by generating examples, observing, and experimenting with examples with a view toward forming generalized conjectures;
- **Sketch2Go** is a qualitative graphing tool. Graphs are sketched using seven icons representing constant, increasing, and decreasing functions that change at constant, increasing, or decreasing rates;
- **Fit2Go** is a linear and quadratic function graphing tool and curve fitter. Students can view a phenomenon, identify variables, conduct experiments and take measurements in order to construct models of the phenomena. (Math4Mobile website)

These tools were used successfully in collaborative groups of 8th grade students to support solving math problems on their mobile phones. Daher (2010) found that these middle school students "advanced their knowledge of ideas as a community collaborating to engage in authentic activities with the help of mobile phones" (p. 101). Another reliable source of classroom applications for cell phones is PBS. Spurred by a 2006 study, "Learning Letters with Elmo Study", PBS has developed an entire website dedicated to mobile learning. Parents in the study were sent literacy tips and streaming video clips about alphabet letters for their three- and four-year old children to watch for eight weeks at least three times each week (Horowitz et al., 2006). Participants reported an increase in their children's knowledge of the alphabet,

and more than three-fourths of the participants living at or below the poverty level reported that the content delivered via their cell phone affected their children's letter knowledge to a good or great extent. Additionally, participants reported:

- That because they always had their cell phones with them, they found it extremely easy to fit literacy activities into their daily routine; and they appreciated the transportability and accessibility.
- Value in handing their cell phone to their children and knowing their child was occupied with an educational activity.
- Almost all their children quickly learned how to view the letter video clips without assistance which allowed children to view the clips repeatedly, serving the dual purposes of occupying the children and utilizing repetition to help the children learn letters and songs (McReynolds, Elek & Ordiz, 2006).

On their mobile learning site, PBS has a number of content related applications for cell phones. For nutrition (Corporal Cup's Food Camp), phonics (Electric Company Word Ball), creativity (Super Why! Paint, Photo Factory), reading (Super Why!), emotions (Make a Journal), vocabulary (Martha Speaks Dog Party) and science (Dinosaur Express) (http://pbskids.org/mobile/). Another reliable source of proven educational applications is the International Society for Technology in Education (ISTE). ISTE lists apps for geography (Beautiful Planet HD), mathematics (Bloomberg), art (Brushes), astronomy (GoSkyWatch Planetarium), and early reading (Dr. Seuss ABC).

Another classroom application is Google Earth, a Geographic Information System (GIS) and virtual globe created by satellite and aircraft images taken at different times with an easy to navigate interface (Baker, 2005; Bodzin, 2008). GIS are computer-based systems that allow users to collect, organize, manipulate, analyze, and display data with a geographic or spatial component (Baker & Case, 2000; Lamb & Johnson, 2010). With Google Earth, users can explore the ocean (Google Ocean), sky (Google Sky), and Mars (Google Mars) as well as Earth. Obviously, this tool has many classroom applications. For example, Google Earth has the potential to increase access to mathematics and science for diverse learners and to provide students with unlimited opportunities to locate evaluate and collect real data. The visual nature of the program has also been shown to engage, motivate and communicate to a variety of learners (Patterson, 2007). A great website that students can

use in conjunction with Google Earth is *Real World Mathematics*. This site focuses on including Google Earth in the mathematics curriculum and provides lesson that are aligned with national mathematics standards.

Students can also use the Internet, camera, and a number of free applications (Picassa, Panoramio, Flickr, Google Earth, Flagr) for geotagging—assigning a unique geo-spatial location to a photograph. In other words, students can be on a field trip and use their cell phones to take a picture and then upload the picture using the app for Picassa, Panoramio or Flickr. These pictures can then be placed on a map with their location and a description. Many of the new smart phones have geotagging built into them and automatically tag pictures on maps including latitude and longitude. The classroom applications of geotagging are many. Holmes (2008) offers a number of lesson suggestions. For example, teachers can use geotagging to generate a game of "Hide and Seek" for students going on a field trip. Prior to the trip, the teacher would create a trail of photos with information that can be used to sequence a walk or geographical treasure hunt. The tagged photographs would assist students' navigational and informational aids to help guide them on the field trip. At each of the locations tagged by the teacher, the students can be asked to carry out a task, e.g. complete a field sketch, conduct an interview, and take a photograph and geotag it (Holmes, 2008). Teachers and students can also add audio to their geotags. GeoGraffiti allows users to add audio markers to their images and to post both to specific locations on the map. In this way students on a field trip could record what they are learning or their impressions of what they are seeing at specific locations during the trip.

The Internet accessed on their cell phones can be used to conduct research, use any number of Web 2.0 applications (e.g., Flickr, YouTube) or to present digital images, podcasts, Internet findings, and personal commentary to the class via their personal or the class wiki, weblog, and/or social networking site. Furthermore, Textbook manufactures like McGraw-Hill are now supplementing their textbooks with mobile-phone-supported educational supplements such as flashcards, key terms, and self-quizzes (Katz, 2005).

Barriers

There are a number of barriers associated with classroom technologies that could also impede the adoption of cell phones for classroom instruction. These barriers are broken

into two categories: external or first-order and internal second-order barriers (Ertmer, 1999; Rogers, 2000). The first-order barriers include a lack of access, funding, time, and training (Ertmer; Means & Olson, 1997; Rogers). Teachers' attitudes about specific technologies function as a second-order barrier to adoption (Ertmer; Means & Olson; Rogers).

Access and cost are the two most prominent barriers that arise when discussing most instructional applications of technology. Although many students have cell phones, as long as one student does not have access, the classroom application is limited. Schools could resolve this problem in two ways. One option would be for schools to have classroom sets of cell phones—much like calculators in a math class (Figure 1). Cells would be assigned to each student, pair, or group of students to use in class and then returned at the end of the class.

The second option would be to assign each student a cell phone at the beginning of the school year. Before dismissing this option because of cost, consider these facts. First, cell phones have become extremely affordable. A 3GS iPhone can be purchased for as little as $49 dollars; while other cell phones can be purchased for as little as $40. The price of a cell phone is not much more than the cost of the literature textbooks assigned to students for each class. Yes, students will lose or damage their phones, but this is also true of textbooks. With the growing amount of digital textual material available on the Internet, it is not hard to imagine a decreased need for cumbersome textbooks in the near future. A quick search of the Internet reveals full versions of *The Scarlet Letter*, *The Great Gatsby*, *War and Peace* and *Ulysses* as well as *North of Boston, Leaves of Grass, Romeo and Juliet*, and *the Canterbury Tales*—all free for reading for anyone with an Internet connection. An application to turn a cell phone into a Kindle is also now available. Furthermore, buy purchasing cell phones, schools would be getting a cell phone, a calculator (including graphing), a computer, a digital camera, a video camera, a GPS, and a student response system for between $40.00 and $50.00.

Once new technologies have been acquired, they often require teachers (and students) to be trained in how to use them. The lack of time on the part of teachers to complete this training as well
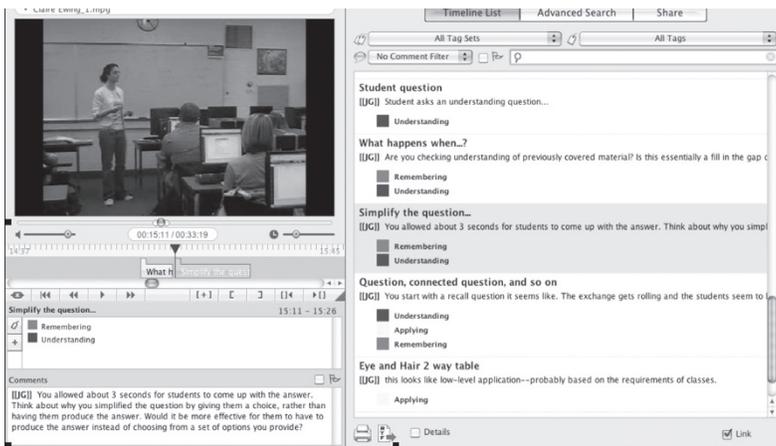

Figure 1. Cell phones could be stored in class sets in holders like calculators in a math classes. Students would receive a phone at the beginning of the class for individual or group work. The phone would be returned at the end of the class.

as a shortage of qualified training staff is a barrier to adoption. However, the ubiquity of cell phones reduces both the amount of time and training needed. After all, 84% of students own a cell phone. The percentage of adults with cell phones is even higher, 85% overall and 96% of young adults (ages 18-29). These adults are using their cell phones for more than just talking (Table 1).

Cell phone owners are already using applications on their mobile devices (texting, internet, camera, video and audio recorders, and mp3 player) that have classroom application, and the number of individuals who own a cell phone is increasing dramatically. From 2004 to 2009, adult ownership increased 20%. Over that same period of time, teen ownership increased by 40% (Lenhart, 2009). As a result of falling prices, increased capabilities, and an explosion of apps, smart phones are overtaking the mobile phone market. By December of 2011, half of wireless subscriptions will be smart phones—an increase of 29% in the last two years (Entner, 2010). Increased ownership and the increasing ubiquity of smart phones will continue to reduce the amount of time and

	Ages 12-17	Ages 18-29	Ages 30-49	Ages 50-64
Take a picture	83	93	83	67
Send or receive text message	85	95	82	57
Access the internet	27	65	43	18
Record a video	32	60	39	14
Send or receive email	21	52	37	22
Play music	60	64	36	13

Table 1. Percentage of cell owners in each age group who do the following on their cell phones (Lenhart, 2009)

need required for training on cell phones.

Teachers' attitudes are also often cited as a second-order barrier to adoption. These underlying beliefs about teaching and learning can be a more serious impediment to fundamental change than first-order barriers (Ertmer, 1999; Dede, 1998) because changing these beliefs requires:

> a radical shift in both teaching style and the teachers' vision of what classroom life is all about....This new vision is one that changes the teacher's role in basic ways, reducing the importance of 'chalk and talk,' increasing the need for sensitivity to individual students' problems and achievements, shifting how classrooms are laid out, how evaluation is conducted, how teachers relate to their colleagues, and hundred other particulars of daily life in schools (Kerr, 1996, p. 24).

Technologies, when used appropriately in the classroom, have the potential to create student-centered learning environments where the teachers have a more facilitative role (Jonassen, Peck, & Wilson, 1999). The first step in assisting teachers in overcoming their underlying beliefs and shifting their instructional and learning paradigm is the creation of a clear vision for how a particular technology can be used to achieve instructional goals (Baker, Herman, & Gearhart, 1996; Roblyer, 1996). In order to develop this vision, teachers need opportunities to "observe models of integrated technology use, to reflect on and discuss their evolving ideas with mentors and peers, and to collaborate with others on meaningful projects as they try out their new ideas about teaching and learning with technology" (Ertmer, 1999, p. 54) in order to identify areas of the curriculum for meaningful integration.

First-order and second-order barriers to the adoption of instructional technology are not unique to cell phones. What is unique is the way that widespread ownership and varied uses of cell phones by teachers and students reduces the impact of many of the first-order barriers. In order to address the second-order barriers, school stakeholders must formulate a vision for the instructional benefits of cell phones in the classroom.

Conclusion

Teachers, administrators, and school boards are afraid that students are using their cell phones for textese, cheating, cyberbullying, and sexting. These fears are not without merit. However, the argument for allowing cell phones in the classroom can be summarized by two Latin phrases. The first is "cum hoc ergo propter hoc" or correlation does not imply causation. Although some students do use cell phones inappropriately, cell phones are not the cause of these behaviors. The second is "ex abusu non arguitur ad usum"—the abuse of a thing is no argument against its use. Instead of banning cells in the classroom, teachers and administrators in schools should be modeling the moral and ethical use of cell phone technology while harnessing their computing power to support sound pedagogical instruction. Cell phones provide teachers and students with a portable computing device that can support anytime/anywhere learning.

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Smart Phone Tool	Shared Instructional Benefits	Individual Instructional Benefit	Example/Tools
SMS Texting	Anywhere Access, Digital Literacy, Student-Centered, Content Creation, Collaboration, Interaction, Communication	Assessment, Reflection, Feedback, Additional Instruction & Practice, Engagement, Improve attention, Improve performance, Differentiate Instruction, Participation	Teachers can assess students: Poll Everywhere Teachers can send reminders to students: Remind 101 Teachers can share assignments with students via a bar code: 　BeQRious 　Kaywa 　3G Vision Students can compose a poem, translate a sentence, answer an assigned question and share via text with teacher or peers.
Digital Camera	Anywhere Access, Digital Literacy, Student-Centered, Content Creation, Collaboration, Interaction, Communication	Authentic Learning, Multitasks, Differentiate Instruction, Data Collection, Analysis, Inquiry, Engagement	Teachers and students can create Digital Stories: 　iMovie 　MovieMaker 　Photostory 3 Teachers and students can post to wikis: 　pbworks.com 　wetpaint.com 　wikispaces.com Teachers and students can post weblogs: 　edublogs.com 　blogger.com Teachers and students can post on websites: 　Google Sites 　Webbly Teachers and students can post to Web 2.0 photo sharing application: 　Flickr 　Picassa 　Panoramio Teachers and students can turn their photos and audio narrative with them into podcasts: 　PhoneCasting 　Gcast 　VoiceThread 　Yodio Teachers and students can use in multimedia projets/presentations: 　PowerPoint 　Open Office 　Prezi

Smart Phone Tool	Shared Instructional Benefits	Individual Instructional Benefit	Example/Tools
Digital Audio/ Video Recorder	Anywhere Access, Digital Literacy, Student-Centered, Content Creation, Collaboration, Interaction, Communication	Authentic Learning, Multitask, Differentiate Instruction, Improve Motivation, Support Higher-Order Thinking, Improve Student's, Writing & Listening Skills, Increase Students' Sense of Ownership & Meaningfulness in their Learning	Teachers and students can create Digital Stories: iMovie MovieMaker Photostory 3 Teachers and students can create podcasts: PhoneCasting Gcast VoiceThread Yodio Audacity Google Voice Teachers and students can post online: YouTube YouTube EDU Teacher Tube Teachers and students can post on a personal or class wiki, weblog, website. Students can conduct interviews to be turned into podcasts, posted online, made into digital stories, or incorporated into multimedia projects.
Internet	Anywhere Access, Digital Literacy, Student-Centered, Content Creation, Collaboration, Interaction, Communication	Authentic Learning, Multitask, Engagement, Research,	Teachers and students can post materials to and access materials on their wikis, weblogs, websites and email accounts. Teachers and students can post and listen to podcasts. Students can access multimedia on YouTube, TeacherTube, YouTube EDU, Discovery Learning, etc. Students can geotag: GeoGraffiti Teachers and students can utilize any number of mobile apps like Math4Mobile.
Teacher Resources and Apps	Lesson Planning, Instruction		I Education Apps Review : http://www.iear.org/ Eric Sailer's Special Education Apps: http://www.scribd.com/doc/24470331/iPhone-iPad-and-iPod-touch-Apps-for-Special-Education (Troutner, 2010) Lisa Nielsen, The Innovative Educator: theinnovativeeducator.blogspot.com PBS Kids: Mobile