Engaging 21st Century Learners and Differentiating Instruction with Technology

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Abstract

Engagement is the key to student learning. Using activities that are relevant and differentiated for 21st century students includes using activities that incorporate technology tools that are a part of their everyday digital lives. The integration of digital technologies into teaching practices requires teachers to acquire new strategies and activities for differentiating instruction for 21st century learners. This paper highlights how technology can be used for differentiated instruction, and describes six specific technologically-enhanced activities that are appropriate authentic uses of technology for differentiating instruction.

Introduction

The integration of digital technologies into teaching practices provides teachers with new strategies and activities for differentiating instruction for 21st century learners. Prensky (2005) describes 21st century learners as having an easy familiarity with:

new systems for communicating (instant messaging), sharing (blogs), buying and selling (eBay), exchanging (peer-to-peer technology), creating (Flash), meeting (3D worlds), collecting (downloads), coordinating (wikis), evaluating (reputation systems), searching (Google analyzing [SETI]), reporting (camera phones), programming (modeling), socializing (chat rooms), and even learning (Web surfing) (p. 10).

Having this skill set, these learners find instruction that incorporates digital technologies meaningful, relevant, and motivational (Oblinger & Oblinger, 2005; Jonassen, Howland, Marra, & Crismond, 2008; Small & Vorgan, 2008).

Differentiation according to learning style (individual or collaborative), preferred learning medium (visual, kinesthetic, or aural), and ability (multiple resources to address multiple levels of academic readiness) is possible when integrating technologically-enhanced activities into the instructional setting (Tomlinson, 2001; Anderson, 2007). However, research has shown that effective integration of technology into classroom instruction for teaching and learning is not widespread (Bracewell, Sicilia, Park, & Tung, 2007; Cuban, Kirkpatrick, & Peck, 2001; Ertmer, 2005; Karsenti, Brodeur, Deaudelin, Larose, & Tardif, 2002). Therefore this paper highlights findings from recent research regarding the knowledge that teachers need in order to effectively integrate technology into instruction (Jaipal & Figg, 2009). This paper also highlights how technology can be used for differentiated instruction, and it describes six specific technologically-enhanced activities that are appropriate, authentic uses of technology for differentiating instruction.

Supporting Successful Lesson Implementation

Many factors impact a teacher's effectiveness when teaching with technology. However, in a recent study, Jaipal and Figg (2009) found three aspects of planning and implementation that have a significant impact on the success of instruction: 1) activity choices (e.g., using the technology for authentic tasks), 2) differentiation techniques (e.g., few skills being introduced in a lesson), and 3) sequencing of activities (e.g., familiarity with a set of types of appropriate tech-enhanced activities). Examples from the research study are presented to illustrate how these three aspects support technology-enhanced instruction.

Activity choices: Using technology in lessons for authentic tasks

Technology used in lessons should be representative of the manner in which the technology is used outside of the classroom (Newmann & Wehlage, 1993). Real world use, as determined by informal surveys of users, indicated that general computer technology is used for the following reasons:

- Research, which includes information-gathering of background information or retrieving factual information,
- Data collection, which includes all forms of collecting, organizing, and analyzing data,
- Communication, which includes direct communication in the form of reading or writing (email, listservs, newsgroups) or publishing and presenting (desktop publishing, web publication, or multimedia presentations of information), and
- Edu-tainment, or education through entertainment venues such as games, simulations, reading of current or popular materials, watching presentations, videos, or animations, listening to music, and shopping.

However, authentic use is also defined as the use of technology tools “when it allows one to either do something that could not be done at all without it or to do something better than could be done without it” (Bryan, 2004. p. 285). Using computers for activities better suited to or more efficiently completed with pencil and paper is not appropriate. For example, using tally marks to collect one small set of data is more manageable as a paper and pen activity than a computer-based spreadsheet activity. However, if the data collection includes a larger sample or the purpose is to compare different sets of data, a spreadsheet would be a more effective tool for the purpose and reflects authentic use. Likewise, an appropriate use of technology to support instruction would be using video that can be stopped in the middle of experimentation so that the learners can measure and examine processes occurring during the experiment. This is an authentic use of video that would be used by scientific researchers in the field and cannot be replicated in a paper and pencil mode.

Differentiation: Introducing a few skills at a time via “just in time” training or chunking of process skills

Teachers in the study by Jaipal and Figg (2009) who selected activities that introduced just a few technical skills at a time took advantage of “just in time” training techniques to build technology proficiency in students while teaching subject area content or concepts. Those teachers who focused on teaching *with* the tool rather than teaching *the* tool found that their lessons were very successful in impacting student understanding whereas those teachers who set out to teach students how to use a computer-based tool, such as PowerPoint or KidPix, ended up

spending a great deal of valuable classroom time teaching computer skills rather than curricular content. For example, one teacher designed a social studies lesson that had students create a graphic organizer depicting the sources of food contained in a “lunchable,” or lunch product that was to be marketed in one of the five economies being investigated in the unit. Students quickly located the sources of ingredients on the Internet and used that information in a concept map drawn with Smart Ideas. The lesson was successful because there were only a few skills needed to manage the technology used in the lesson, and the technology (the Internet and Smart Ideas) served to support the students’ knowledge acquisition as part of the learning activity.

In contrast, another teacher’s lesson required Grade 4 students to learn multiple computer skills to create a slideshow—all in one fifty-minute lesson. They had to search the Internet, locate pictures and information about animals, and create a slideshow using that information. The lesson soon disintegrated into chaos because these students could not learn so many technical skills in one lesson. Teachers therefore need to be cognizant of the variety of skill levels their students will have with different technology tools and focus on teaching a few skills while learning the content.

Scaffolding may need to be provided to facilitate understanding of the process required to complete some complex technologically-enhanced activities (such as creating a slideshow). Teachers in the study who were able to “chunk” the required processes into a few steps, even assigning an acronym for those steps, were successful in the lesson implementation. One example of successful “chunking” is introducing students to NETS, a term coined by Bernie Dodge (2008), to teach web searchers to Narrow the search, use an Exact phrase, Trim back the URL, and look for Similar pages, a process which provides novice Internet searchers with four specific ways to increase searching productivity and an acronym to assist in remembering those strategies.

Differentiation techniques for technologically-enhanced lessons include providing supports during lesson implementation as well as designing properly scaffolded lessons. Teachers in the study found that a well designed, brief handout provided to students during lesson implementation could be used to differentiate for differing technical skill levels as well as levels of reading abilities. Compare the examples in figure 1 and note that the Grade 4 handout provides too much detail whereas the Grade 7 handout is clear, concise, and easy to follow.

Additionally, adding preliminary or anticipatory activities to activate prior knowledge from students' previous experiences with technology into the introductory activities of the lesson served to assist students in making connections before using the technology to learn content or create products. For example, one teacher provided an exemplar of a concept web that she created to guide discussion of how resources from many places become the lunch product students had brought for their meal. By modeling the concept web before asking students to create their own concept web, she provided a framework of expectations for student performance during the activity.

Sample of one section of a two-page Grade 4 Handout for KidPix

Transitions

- When all your slides have been saved on your slideshow, go to the left side of the screen where the film is with the red arrow on it. This is the slide transitions button
- This will make a time appear on the bottom of your slide as well as red arrows
- Click on the first arrow beside your first slide
- "Select Transition and Sound" pops up. This is where you decide how your slide will come onto the screen
- Select which ones you think you want. Click Preview to see what it looks like
- If you like it, click ok. If not choose different ones and preview again
- Next, click on the second button. Select one of the options and press ok
- Repeat this process for all of the slides

Sample of one section of a Grade 7 Handout for SmartIdeas 5

1. Using your mouse select *Start* at the bottom left hand corner of your screen, and click on *SmartIdeas 5*.
2. Immediately go to Layout at the top of your screen, and click on the dark arrow button:
Then select- Bottom Tree Angled
3. Choose a symbol in the space provided on the left by simply clicking on the one you would like to use.
4. Then choose a connector by clicking on it with your mouse.

Figure 1. Comparison between Grade 4 handout with too much detail and Grade 7 handout with clear concise steps

Sequencing: Familiarity with a set of appropriate technology-enhanced activities.

One stumbling block for the teachers in this study (Figg & Jaipal, 2009) was the initial planning decision regarding what types of activities could be used to integrate technology into the lesson. As they were new to teaching with technology, the teachers lacked “a repertoire of practices” (Joyce, Weil, & Calhoun, 2004, p. 6) or activities that could be adapted or revised to meet various learning outcomes. Teachers who were new to integrating technology into instruction appeared to be more confident in the design stage when they had knowledge of tech-enhanced activities, such as the over sixty-plus activities listed on <http://www.handy4class.com> or information about activity types found on <http://activitytypes.wmwikis.net/>. With this knowledge, they could sequence activities to appropriately scaffold learning and differentiate instruction.

Six examples of technologically-enhanced activities that provide for differentiation are presented below. Each activity is illustrated with an example and resources for their use.

1. *Edublogs*. Creating edublogs—blogs created for educational use (Ray, 2006)—is a simple five-step process that takes fifteen minutes (using a tool such as *Blogger*, with free accounts available at <http://www.blogger.com>). Online blogging tools allow teachers the flexibility to create a variety of online differentiated supports in the form of edublogs.

For example, the Internet presents students with information overload at the click of a mouse; teachers can support students in conducting efficient Internet searches by providing online guides differentiated by reading levels. These guides include Treasure hunts and Scavenger hunts. Treasure hunts display a list of questions with embedded links in each question to web pages containing the answers to the questions (see example at <http://starwarshunt.blogspot.com/>). Scavenger hunts are appropriate for students with more advanced searching skills as these hunts list questions without the embedded links to the answer web page, but with keywords that can be used as search topics in a search engine such as Google (see examples at <http://www.figg.com/ired320/portfolio/scavenger.htm> and <http://lostliners.blogspot.com/>).

Teachers can use edublogs to target specific learning needs by providing links in the messages to differentiated and engaging Internet activities and games (see example of a

curricular-based edublog at <http://scienceisfun4us.blogspot.com/>). Also, students can be permitted to interact with each other through commenting or responding to posted messages, thereby extending reflection on learning in a safe, easily-monitored environment. As well, with the messages from the teacher available publicly online, parents have an opportunity to view the resources provided and are drawn into the learning activity.

The ease of creating edublogs enables students (Grades 3 and up) to build their own journals, Internet searches, or collection of resources in order to present knowledge learned or information collected, making an edublog an appropriate culminating unit project that differentiates for student interest.

2. *Virtual Field Trips*. Another useful Internet search is a virtual field trip, an activity in which student “tourists” visit one large website (such as those sponsored by NASA, SeaWorld, or the Royal BC Museum) or several related websites to simulate a field trip to locations too remote (or too virtual) to be physically visited by students. The virtual field trip consists of an online “trip guide,” which is a series of directions and questions that guide the students through the various web pages informing them of the highlights to explore throughout the tour. Students receive the same information in hard copy format useful for note-taking and collecting information as they take the “tour.”

There are many virtual field trips available online through sites such as *Virtual Field Trips* at <http://www.uen.org/utahlink/tours/> and *Tramline* at <http://www.field-trips.org/>, which also provide tools for creating new trips. *Internet4classrooms* has an excellent site with additional links to virtual field trips as well as resources for best practices in creating virtual field trips (available at <http://www.internet4classrooms.com/vft.htm>).

However, teachers can easily personalize virtual field trips to meet their own students’ learning needs by using a blogging tool (such as *Blogger*). By creating their own virtual field trips, teachers can differentiate for student interest in topics by selecting sites with varying degrees of detail, providing some information with general explanations and others with in-depth, full or scientific explanations. Teachers can build in differentiation for varying learning preferences by linking the online guide to podcasts for aural learners or short video clips for visual learners, such as those from *TeacherTube.com*. Both the online guide and the hard copies

of the guide can be modified as needed to meet specific reading levels, or be supported with podcasts that read the guide for the student.

Samples of teacher-created study guides can be found at http://www.figg.com/activity_types/vftexample1.pdf and http://www.figg.com/activity_types/vftexample2.pdf.

3. *WebQuests*. Bernie Dodge (2007) defines a WebQuest as “an inquiry-oriented lesson format in which most or all the information that learners work with comes from the web.” The WebQuest is valued as a highly constructivist teaching method, meaning that students are encouraged to find, synthesize, and analyze information in a hands-on, but guided, fashion, actively constructing their own understanding of the material.

A WebQuest lesson guides the learner through a task by providing a procedure for doing the task and the resources needed for the task. Most WebQuests focus on tasks that require group work for completion, making them popular examples of cooperative learning. For differentiation purposes, WebQuests often have students assume different roles in completing the task or assign specific pieces of the task to different team members, thereby developing teamwork skills. Teachers are able to structure student teams so that they will support each other in building teamwork skills as well as provide academic support.

There are databases with over 2500 WebQuests already created by teachers available at <http://webquest.org/search/index.php> and <http://bestwebquests.com>. However, teachers wishing to personalize WebQuests for their own students can use the *QuestGarden.com* tool (QuestGarden, 2009) to publish their WebQuests to the Internet (available at <http://QuestGarden.com>). *WebQuest.org* also offers multiple resources that provide best practices and guides for the WebQuest creation process.

4. *eBooks*. *Dictionary.com* (n.d.) defines the term *eBook* as an electronic book or any book published in electronic or digital form. Thus, any written piece that is published electronically—either in PowerPoint, MS Word, web page editing tools, or in electronic form for portable devices or publication on the Internet—is considered an eBook.

eBooks offer teachers many choices when differentiating for student needs. Newer eBook tools offer students the ability to highlight passages that need to be remembered for discussion

purposes. Students can even electronically bookmark areas for future use and add electronic notes to remind themselves why they chose these passages. Easy access to an online dictionary and thesaurus provides students with two tools to increase comprehension. There are even free reader programs, such as *NaturalReader*, *PleaseRead*, and *HearIt for Mac*, that convert the text of eBooks into audio. And, there are tens of thousands of eBooks available for free on the Internet through sites such as the University of Virginia's eBook Library at <http://etext.lib.virginia.edu/ebooks/ebooklist.html> or commercial sites like *The eBook Directory* at <http://ebookdirectory.com> or *Manybooks.net* at <http://manybooks.net>.

However, having students use PowerPoint and other slideshow or video-making tools to create their own eBooks is an even more powerful means of getting students to synthesize and communicate understanding based on their own ability level and readiness. A simple "show and tell" storybook eBook made from several digital pictures is easily created with free photo album tools, such as *Picasa*, Microsoft *Photo Story*, or Apple *iPhoto*. Although some photo album applications will allow the addition of music, a movie-making tool, such as Microsoft *MovieMaker* or Apple *iMovie*, provides more capabilities with the same ease of use.

Both the Microsoft and Apple web sites offer instructive tutorials for story-making tools, and there are many other tutorials online. Cavanaugh & Cavanaugh (2008) provide a simple tutorial for creating eBooks using PowerPoint at http://drscavanaugh.org/ebooks/creating_ebooks_with_powerpoint.htm.

5. *Podcasts*. Podcasts are digital recordings of audio or video data, similar to "Books On Tape," delivered directly to your computer or MP3 player via download from the Internet. Fasimpaur & Emerson (2009), founders of K-12 Handhelds, explain that, in the educational setting, a podcast is "a powerful publishing platform that addresses different learning styles, is highly mobile, and can deliver content "just in time." However, these reasons are just as valid for differentiation of instruction. Podcasts can be created by the teacher to target specific learning needs of individual students or to provide groups of students with self-directed learning activities conducted while the teacher works with students of special needs. Students can easily create podcasts, affording them opportunities to express knowledge in multiple ways.

Fortunately, many quality educational podcasts are available online. *10 Podcasts for Teachers and Kids* (at <http://content.scholastic.com/browse/article.jsp?id=11531>) is just one

example of the multitude of sites that review and present quality podcasts for teachers. *K-12 Handhelds* (at <http://www.k12handhelds.com/podcasting.php>) *Learninginhand* (at <http://learninginhand.com/podcasting/index.html>), and *The Education Podcast Network* (at <http://epnweb.org/>) are three excellent resources for podcasting.

Podcasts are simple to create using a microphone and free downloadable recording tools, such as *Audacity* (available at <http://audacity.sourceforge.net>). The audio files can then be published on the Internet using the free hosting/podcast-creation tool, *G-Cast* (available at <http://www.gcast.com/>). *G-Cast* even provides directions for publishing a link to the hosted podcasts on an edublog so podcasts can be shared via the student's or teacher's edublog.

6. *Concept Maps*. Concept maps are constructed to link two or more concepts together by words that describe their relationship. *Dictionary.com* (n.d.) defines a concept map as "a type of diagram which shows various relationships between concepts."

Concept maps differentiate learning because they are visual representations that allow students to organize knowledge and encourage understanding by emphasizing connections that build conceptual knowledge. The concept-mapping process engages learners in opportunities to describe, compare/contrast, classify, sequence, make causal connections, or make decisions.

The *S.C.O.R.E.* website at <http://www.sdcoe.k12.ca.us/score/actbank/torganiz.htm> presents a variety and diversity of concept maps and graphic organizers available for instructional use. As well, there are several user-friendly software applications that make the concept-mapping creation process simple (such as *Inspiration* or *SmartIdeas*), but there are also online tools such as *ReadWriteThink*'s Webbing Tool (at http://www.readwritethink.org/student_mat/student_material.asp?id=38), *Bubbl.us* (at <http://www.bubbl.us/>), or *Gliffy* (at <http://www.gliffy.com/gliffy/>). New tools are always being developed, such as the new *Webspiration* by Inspiration, which is an online version of their powerful concept mapping tool, *Inspiration*.

Conclusion

Engagement is the key to student learning. Using activities that are relevant and differentiated for 21st century students includes using activities that incorporate technology tools

that are a part of their everyday digital lives. There is therefore a need for teachers to become proficient designers of instruction with these tools. We have drawn from research to highlight aspects of teacher knowledge that contribute to successful design of technologically-enhanced teaching and learning experiences in a classroom. Teacher knowledge of a repertoire of tech-enhanced activities, knowledge of how to sequence activities in ways that focus on introducing teaching of subject matter content rather than tech skills, and introducing a few skills at a time in a lesson are significant in this process of designing lessons that integrate technology for differentiation.

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