As. J. Education & Learning **2010**, 1(1), 2-9

Asian Journal on Education and Learning

ISSN

Available online at www.ajel.info

Discussion Paper

Hands-on instructional strategies for the 21st century

O. Susan Frusher*, Jaclyn P. Bonner and Renée L. Cambiano

Department of Educational Foundations and Leadership, Bagley Hall (Ed Bldg) 103G, Northeastern State University, 616 N Grand Ave, Tahlequah, OK 74464 USA.

*Author to whom correspondence should be addressed, email: frusher@nsuok.edu

This paper was originally presented at the International Conference on the Role of Universities in Hands-On Education, Chiang Mai, Thailand, August 2009.

Abstract

This paper examines various research-based hands-on instructional strategies for the 21st century that can be used across the curriculum. Among the strategies discussed and examined are nonlinguistic organizers, cooperative learning; learning styles and technology-based examples such as the use of wiki. Instruction must facilitate students learning skills deemed necessary for thriving, not only surviving, in the 21st century: critical thinking, collaboration, creativity, adaptability and global awareness. While this paper cannot cover all examples of instructional strategies necessary for the 21st century where technology is an integral part of our lives and information doubles every 72 hours; the authors endeavor to cover selected research-based effective instructional strategies.

Keywords: nonlinguistic organizers, cooperative learning, Internet, Wikipedia

Introduction

Although we are in the 21st century, most educational paradigms are still firmly rooted in the 20th century and some even in the 19th century. To reach students of all ages and in all venues, teachers need to understand the unparalleled challenges of the 21st century and how instruction can facilitate learning skills necessary for students to "thrive, not just survive." [1, 2].

Why is the 21st century different and how does this time period affect all learning venues? The challenges instructors face in the 21st century are well documented. Clearly, the most obvious evident reason is technology. Technology, as never before, is an

integral part of students' lives. For example, many students world-wide may not have access to computers but most have or can easily use cell-phones. It is not a stretch to say that while many teachers are lecturing many students are simultaneously using their cell phones to text or twitter. Walser [1] cites Wagner [3] and others to "point to signs of student disengagement from traditional forms of learning that value memorization and mastery of content over student-designed demonstration of skills." It is a fair assessment based on observation to say that many students are more interested in texting than lecture notes being written on a board and that technology now allows them to disengage from the classroom.

Not only is technology changing at an unprecedented pace, but so is information. In fact, some suggest that information not only doubles at a rate of every 72 hours, but also may become outdated as quickly. In a rapidly changing world, teachers must not only stay current themselves, but also facilitate learning skills such as critical thinking, collaboration, creativity, adaptability and global awareness [1, 4] that are deemed necessary for students to succeed in this century. "Some of these skills have always been important but are now taking on another meaning—like collaboration. Now you have to be able to collaborate across the globe with someone you might never meet," explains Christopher Dede, a Harvard professor who sits on the Massachusetts 21st Century Skills Task Force [5]. "Some are unique to the 21st century. It's only relatively recently, for example, that you could get two million hits on an (Internet) search and have to filter down to five that you want." Coupled with the challenges of the 21st century, teaching can indeed be daunting.

How can instructors teach and facilitate these crucial learning skills that are beyond the old paradigm of information acquisition and content-knowledge-based curriculum? For starters, use of technology in the classroom is a hands-on strategy that engages the learner. Many instructional strategies can be adapted to incorporate technology. The Horizon Project (http://wp.nmc.org/horizon/2009), which is a global effort, issues an annual report that identifies a list of technologies, based on qualitative research methods, the time-to-adoption horizon, trends and challenges, that affect education, industry and even museums. The top six technologies and applications that emerged at the top of the Horizon Report 2009 were: mobiles, cloud computing, geo-everything, the personal web, semantic-aware applications, and smart objects. A brief explanation of the use of these top six technologies follows.

New Technologies

"Mobiles are already in use as tools in education on many campuses. New interfaces, the ability to connect to wifi and Global Positioning Systems (GPS) in addition to a variety of cellular networks, and the availability of third-party applications have created a device with nearly infinite possibilities" (p. 8) and applications to education. A few specific applications of mobiles across disciplines include: Computer Science – At Clemson University, students are developing tools with a pedagogical or social focus for mobile devices (p. 9). Mathematics – Students can use iPhones for sophisticated calculators by choosing custom applications. Campus Life – Universities such as Stanford have commissioned custom applications that include campus maps, course listings, campus

directory and other campus-related information. Music – Applications can be used for ear training, reading music and instrument simulators.

Cloud computing involves very large, specialized data centers that host thousands of servers. Cloud computing makes it possible for almost anyone to deploy tools that can scale on demand to serve as many users as desired." Applications are always available, even if the technology that supports the application is not visible to the user. Examples on campus include: Science Clouds is a project that aspires to provide cloud computing resources to members of scientific communities for specific projects. "Scientists may even request time on the clouds in exchange for a short write-up of their projects." (p. 12). Earthbrowser (http://www.earthbrowser.com) creates an interactive map populated with "weather, geological, and other data." This application "combines a desktop interface with the data storage and computing power available in the cloud and is a powerful tool, once only available at large computing centers, now available to anyone." (p. 12-13). Still another use of cloud computing is for Media Studies. Using cloud-based applications like YouTube, "a media culture course tracks emerging up-to-the-moment social trends through real-time news clips and user-created content posted there." (p. 13). YouTube and other cloud-based applications can host media that cannot be hosted using resources on campuses.

The technology for geolocation is not new but the fact that many software tools are being made to include features that make use of geolocative data and it is now commonly available in many handheld devices such as mobile phones is new. Applications in education include: Literature – "Geotagging and virtual geocaching can be used to create annotated maps of real-world locations related to works of literature." (p. 16).

Games-based learning – Applications allow the learner to experience settings in real-life neighborhoods and ecological habitats. When combined with alternate reality games, the learner can "immerse in a physical space as they explore the unique characteristics of the location and inhabitants." (p. 17).

The Personal Web is a term "coined to represent a collection of technologies that confer the ability to reorganize, configure and manage online content rather than just using it…. People everywhere and of all ages are creating customized personalized web-based environments to support their social, professional, and learning activities using whatever tools they prefer." (p. 19). These might include blogging sites, as well as tools like Twitter, Facebook, YouTube and Flickr. Twitter could be used to update courses to complete textbooks authored on collaborative networking sites, the content of education is increasingly published online by those most immediately involved in it." Obviously collaborative work is facilitated by these tools as never before. A few applications include: Library Research – Instead of purchasing textbooks, students could be required to buy a USB flash storage drive which, after installation of a web browser and applications on the drive, becomes their research tool. Media Studies – The use of online tools to aggregate and publish web content in e-book form.

Semantic-Aware Applications are tools "designed to use the meaning, or semantics, of information on the Internet to make connections and provide answers that would

otherwise entail a great deal of time and effort." (p. 23). Although online data is easily available for searching, "its meaning is not. Computers are very good at returning keywords, but very bad at understanding the context in which keywords are used. Also, information may be scattered among different pages and sources." (p. 23).

Specific examples include: Research – Semantic-Aware applications can be used to draw "connections and combine data from a wide variety of sources, including bibliographies, prehistoric excavations, and industrial heritage" (p. 25) to create cultural heritage information about a particular region. Collections Tagging – Currently the "Powerhouse Museum of Science and Design in Sydney, Australia is using Open Calais to add contextual tags to objects in its online collection." (p. 25).

Finally, Smart Objects "know" about themselves and their environment and the fact that a single smart object can connect to a network of information is "useful for many disciplines." (p. 28). Examples include: Archaeology – "A tag attached to the label of each object, when scanned with a mobile device like a camera-enabled phone, would instantly bring up photographs of other objects from the dig, video of the dig site, maps, and any other media or information associated with the area." (p. 28). Health care – Researchers and students at the University of Arkansas have created a simulated hospital environment in the virtual world of Second Life to test the practical and social implications of tagging and tracking patients, hospital staff, supplies and locations. (http://www.rfidjournal.com/article/articlereview/4326/2/1/). (p. 28).

Other examples of technology that can be and are being used in education include wiki, YouTube, Twitter and Facebook. A wiki (which is a Hawaiian word for "fast") is a website that uses wiki software, allowing the easy creation and editing of any number of interlinked Web pages within the browser. Wikis are often used to create collaborative websites, such as educational and community websites, and can be used for note taking. The collaborative encyclopedia Wikipedia is one of the best-known wikis. (http://en.wikipedia.org/wiki/Wiki#cite_note-Britannica-1, 2009.) Of course wikis can be read-only websites, but their strength is that people can work collaboratively on the site with only a web browser. Students and teachers can more easily work together on research and reports through the use of a wiki. (http://www.scienceofspectroscopy.info/edit/index.php?title=Using_wiki_in_education). There are websites that even encourage sharing of how wikis are used in particular classrooms.
(http://wikisineducation.wetpaint.com/page/How+we+use+wikis+in+class?t=anon)

YouTube, the vehicle that allows posting and sharing of videos online, easily becomes a hands-on tool for classrooms. YouTube can be used for "guest" lectures, classroom demonstrations, even movie clips to augment instruction. Twitter, which is a free "service for friends, family, and co–workers to communicate and stay connected through the exchange of quick, frequent answers to one simple question: What are you doing?" (http://twitter.com/). Tweets (messages that Twitterers post) can be used by teachers, publishers to update class content. Facebook, which is a free, social networking website, can also be used for instruction. A simple example would be to use Facebook as a cybercafé for the discussion and sharing of class material. With technology being used

and changing at unprecedented pace, clearly new online formats will be continually added.

Other Strategies

All of these instructional strategies require internet access, which is readily available in many parts of the world, however, what can educators do to facilitate the 21st century learning skills necessary for students when many cannot afford new technology? In many areas of the world—even the most developed countries such as the United States—instructors may not have the funding for even the most basic technology. While most educators are committed to technology, economics do not always allow the purchase and use of say, computers, let alone state-of-the-art technology. According to Wagner [3] we don't necessarily need to use a lot of technology. Although projects that "involve computers, software, and other devices" are important, sometimes "it's simply a matter of approaching an assignment differently to allow students to demonstrate skills like teamwork, collaboration and self-directed learning." Teachers must also coach students on how to advance to the next level of a particular skill. Specific instructional strategies in the 21st century classroom that actively engage learners might include a Socratic Seminar, a "Beautifying the Neighborhood" project, "Saving a River" actually building a bridge, making a movie. These projects help promote critical thinking, collaboration, communication and even global awareness.

Furthermore, specific hands-on strategies include: nonlinguistic organizers, cooperative learning methods and learning styles. Nonlinguistic organizers, including mapping, are a way of making the information visual through an imagery form. Marzano [6], suggests that nonlinguistic representations are one of the most underused instructional strategies. This strategy is based on a dual-coding theory of information storage [7], and is based on the concept that knowledge is stored in two forms—linguistically and through imagery. Obviously the linguistic form is semantic in nature; however, the imagery form is through mental pictures and even physical sensations.

Nonlinguistic representation can be easily created in the classroom. In fact, probably many students have unwittingly created a "nonlinguistic representation" without knowing what it is called when they have doodled or drawn pictures of lecture information or mapped the information. There is currently even an application for mind maps on the iPhone, known as SuperMindX, but this is a discussion of strategies without the use of technology. Nonlinguistic representations include Venn diagrams and graphic organizers, which can be descriptive, time-sequence patterns, process/cause-effect patterns, episode patterns, concept patterns, to name a few. Other nonlinguistic representations include making physical models of the information, generating mental pictures, such as formulas, drawing pictures and engaging learners in kinesthetic activity [7].

Still another hands-on instructional strategy that does not require the use of technology is cooperative learning. This method facilitates teamwork [7], because it incorporates the use of grouping strategies. Five defining elements of cooperative learning according to Johnson and Johnson [8] are positive interdependence, face-to-face promotive

interaction, individual and group accountability, interpersonal and small group skills, and group processing (reflecting on how well the team is functioning and how to function better). There are many guidelines such as group size that should be considered to aid in the success of this instructional strategy. However, all of the guidelines, which require some forethought, are easy and simple, which allows cooperative learning to be one of the most flexible and powerful strategies [7].

Learning Styles

Finally, learning styles, the way in which learners concentrate on, process, and retain new and difficult information [9, 10], can help not only younger students, but also help adult learners enhance their classroom skills. Understanding one's learning style then can help the learner improve achievement in class [11]. Although many learning style models have emerged over the years, the Dunn and Dunn Model is the most research-based, prolific and arguably most global paradigm. According to Dunn, Thies and Honigsfeld [12], learning style is a biological and developmental set of personal characteristics that make the identical instruction effective for some students and ineffective for others.

Individual learning styles can be ascertained through an instrument known as the Productivity Environmental Preference Survey (PEPS) which asks a series of questions about the learner's instructional and environmental preferences. Dunn and Dunn [9] identify five dimensions that score various preferences:

1. Environmental preferences such as sound, light, temperature and class design.
2. Emotional preferences addressing motivation, persistence, responsibility and structure.
3. Sociological preferences for learning in private, dyads, peers, teams, or with adults.
4. Psychological preferences relating to perception, intake, time and mobility.
5. Psychological preferences based on items such as analytic or global, brain-hemisphericity.

Initially, the novice may look at the number of elements as overwhelming, and while it is true that the model is composed of twenty-one elements, one should keep in mind that the model is very thorough and that there are elements that typically emerge as somewhat universal. The elements that tend to affect a lot of individuals' learning styles are light (amount of), sound, temperature, intake (whether one likes to eat and drink while learning something new and difficult), optimal time of day for learning and mobility. These elements are somewhat easily modified for the classroom. And once learners are aware of their own learning style, they can manage their own adaptation when learning something new and difficult.

Clearly, learning styles are a hands-on instructional strategy that can be easily used in learning settings without much technology—and certainly without the internet. Much has been published by not only Rita and Kenneth Dunn, but also by numerous other authors, therefore a more in-depth explanation and application of the Dunn and Dunn Model of learning styles can be easily obtained.

For the critic of the use of hands-on instructional strategies who wonders "how learning would be measured" it must be remembered that assessment is not only the use of traditional multiple-choice tests but alternative methods such as rubrics, portfolios etc., which can provide real-world assessment for the 21st century. Employers rarely engage in traditional tests, but look at whether the employee can "do the job and in a timely manner." It has even been postulated that many employers when faced with downsizing look at whether employees are "team players" and can work with others.

Conclusion

Hands-on instructional strategies, whether internet-based or relationship-based, play a vital role in education. "There is no one best approach for teaching 21st century skills. Each school system must determine what makes the most sense given their unique circumstances." [2]. All of the aforementioned instructional strategies can be adapted and used across the curriculum and can be parlayed into real-world applications and on-the-job application. What is certain is that teachers and educational institutions must be supportive, must examine their instructional strategies, adapt and change where necessary to facilitate students learning the necessary skills for the 21st century.

References

1. Walser, N. (2008). Teaching 21st century skills. **Harvard Education Letters**, 24(5), 1-3. Retrieved from the EBSCO database.

2. Roberts, S. (2009). *Using 21st century skills in the classroom to increase student motivation.* Unpublished paper, Northeastern State University, Tahlequah, Oklahoma.

3. Wagner, T. (2008). *The global achievement gap*. New York: Basic Books.

4. The Partnership for 21st Century Skills. (2009, March 11). *The Partnership's Statement on President Barack Obama's Education Plan*. Retrieved April 14, 2009, from http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=628&Itemid=64

5. Dede, C. (2000). Emerging influence of technology on school curriculum. **Journal of Curriculum Studies**, *32*(2), 281-303. Retrieved from the EBSCO database.

6. Marzano, R.J. (1998). *A theory-based meta-analysis of research on instruction*. Aurora, CO: Mid-continent Research for Education and Learning. (ERIC Document Reproduction Service No. ED 427 087).

7. Marzano, R.J., Pickering, D.J. and Pollock, J.E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

8. Johnson, D.W. and Johnson, R.T. (1999). *Learning together and alone: Cooperative, competitive, and individualistic learning.* Boston: Allyn & Bacon.

9. Dunn, R. & Dunn, K. (1978). *Teaching students through their individual learning styles: A practical approach.* Reston, VA: Prentice Hall.

10. O'Connor, T. (2009) *Using learning styles to adapt technology for higher education*. Center for Instruction Research and Technology, Indiana State University, Terre Haute. Retrieved April 27, 2009, from http://www1.indstate.edu/cirt/facdev/pedagogies/styles/learning.html

11. Honigsfeld, A., & Dunn, R. (2006). Learning-style characteristics of adult learners. *Delta Kappa Gamma Bulletin, 72* (2), 14-19.

12. Dunn, R., Thies, A. P., & Honigsfeld, A. (2001). *Model research: Analysis from a neuropsychological perspective.* Jamaica, NY: St. John's University, Center for the Study of Learning and Teaching Styles.

Internet sources:

http://en.wikipedia.org/wiki/Wiki#cite_note-Britannica-1

http://www.learningstyles.net/index.php?option=com_content&task=view&id=20&Itemid=70

http://portal.acm.org/citation.cfm?id=1149453.1149479

http://www.scienceofspectroscopy.info/edit/index.php?title=Using_wiki_in_education

http://www.shambles.net/pages/learning/ict/wikiedu/

http://twitter.com/

http://www.youtube.com/watch?v=_A-ZVCjfWf8

http://wikisineducation.wetpaint.com/page/How+we+use+wikis+in+class?t=anon

http://wp.nmc.org/horizon2009/