WSSDA RESEARCH BLAST

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Focus: *Technology in the Classroom*

This edition of the WSSDA Research Blast focuses on technology in the classroom. The overview examines three emerging trends including Bring Your Own Device (BYOD), the flipped classroom and digital game-based learning. The benefits and drawbacks are to each are discussed as well as how they can affect student achievement and engagement.

In today's world it is nearly impossible to go a full day without using some form of digital technology. Smartphones, tablets and laptops allow us to "tweet", "like" and update our statuses at any time from any place. Many companies now require basic computer proficiency to be considered for a job. There is also a growing demand to fill positions in the IT and computer science fields. At times, it may seem that technology is evolving so rapidly that it is difficult to keep up. The ever-changing technology landscape has given rise to a new dilemma. How do we adequately prepare today's students to excel professional and personally in a world that relies so heavily on technology? There may not be a universal approach for implementation, but research shows that when applied correctly, technology in the classroom can foster gains in academic performance and student enthusiasm.

How is technology in the classroom defined?

Technology develops so quickly that it can be difficult to understand what "technology in the classroom" means. On one hand, it can mean using technology to assist in the learning process. In some school districts, that means advanced technologies like robotics or interactive whiteboards. In other districts, it means desktop computers in each classroom or a speaker system. On the other hand, it can mean teaching students how to use current technology so that they are adequately prepared for the demands of today's world. This article examines both how technology assists with learning while simultaneously training students for future success.

Bring Your Own Device

Owning a personal electronic device has become the norm for students of all ages. This trend has given rise to the Bring Your Own Device (BYOD) model. BYOD is the practice of allowing students to bring their personal laptops, smartphones or tablets to school to enrich and supplement their learning experience. Compared to other classroom technology initiatives such as 1:1 laptop programs, BYOD is a relatively cost-efficient option as the students provide their own digital tools.

Students are able to use their devices to research information, complete and submit assignments and interact with their classmates online. The unique capabilities of each device allow students to tackle non-traditional assignments. The ability to capture, upload and share pictures, videos and recordings offers the opportunity to enhance instructional materials and assignments with real-world examples from outside of the classroom.

Recent research has suggested that there are numerous benefits to implementing a BYOD model including:

- Increasing skills relevant to workplace and higher education requirements
- Personalizing the learning experience and giving students a sense of ownership
- Promoting learning anytime, anywhere
- Allowing collaboration between students outside of the classroom via digital interactions using mobile applications
- Reducing direct costs for technology and technology maintenance
- Creating a seamless learning environment between school and home

Personal devices offer the benefit of allowing students to access information beyond what is available in textbooks, but there are still potential issues that should be considered. School districts should ensure that they can provide adequate security, bandwidth and curriculum that work across a variety of devices. There should also be efforts to curtail bullying that may result from inequity of the devices owned by students. To combat these problems and minimize the distractions of digital devices, school districts should adopt an Acceptable Use Policy (AUP) designed specifically for students who will be using their personal device. Last year, several schools in Vancouver, Washington piloted a Bring Your Own Device program. An example of their AUP digital contract can be viewed here.

BYOD is relatively commonplace in college classrooms, but its move to K-12 classes is recent and research continues to be carried out on the method's effectiveness for this age group. It is clear though, that it allows students and teachers to engage with the most up-to-date technology in an on-going basis. Districts are also able to save money that they can then invest in students that may have difficulty purchasing personal digital devices.

The Flipped Classroom

Many school districts have started to experiment with a flipped classroom, a concept that was first piloted in 2007 by Colorado teachers Jonathan Bergman and Aaron Sams. The model reverses the traditional lecture and homework elements of a course. Students are assigned to watch short, (usually five to seven minutes) pre-recorded lectures at home. Those who do not have home Internet access are given the opportunity to watch the lectures on school computers. Every student has the ability to communicate with the teacher and fellow classmates via online discussions. The following day, the students complete hands-on activities in the classroom that allow them to inquire about the lecture content, test their knowledge and engage in collaborative assignments with others. The teacher acts as an advisor, helping them to work through and master concepts that may be difficult.

Proponents of the flipped classroom point to the model as having many benefits including:

- *Instant feedback*- teachers have more time to explain difficult material
- *Less student frustration*- students no longer give up on difficult homework assignments since a teacher available to guide them
- *Personalized attention*- teachers can individually address questions that students write down while watching the lectures and offer support that may not be available outside of class
- *Repetition and responsibility*- if a student misses an important point in the lecture, he or she can easily rewind and repeat the segment. In turn, the student sets a comfortable learning pace and assumes greater responsibility of his or her education.
- *Social interaction*- collaborative assignments encourage students to work together to find a solution and learn from one another

The method also has the ability to positively impact student achievement and involvement in historically low-performing urban schools. In 2011, Michigan's Clintondale High School became the first school to apply a completely flipped approach. As a result, the graduation rate, course pass rate and test performance all significantly improved. More students applied to and attended college and the number of discipline referrals dropped from 736 to 249. While most schools do not make the decision to switch to an entirely flipped model, incorporating even some of the technique into lessons has the ability to improve student performance.

But flipping a classroom is not easy. It is a comprehensive overhaul in the class dynamic that presents its own set of difficulties. One major concern is the amount of extra time and effort it takes to record and post lectures. The possibility that students will skip class more often in the belief that they can just view the content online is another concern. Lastly, there is a risk that not all digital devices have the same capabilities when it comes to streaming videos. These issues and the unique needs of each school should be addressed when considering a flipped classroom system.

Since 2007, the flipped classroom has been steadily growing in popularity. With over a million students dropping out of high school each year, educators continually look for alternatives that will better engage students as opposed to the traditional one-size-fits-all education that is so often used. The availability of online video and increased access to technology such as smart phones, tablets and laptops has also made the flipped classroom a viable option.

Digital Game-Based Learning

Video and computer games have grown increasingly more popular and accessible because of mobile devices. They offer an environment that is engaging, motivational, fun and challenging - qualities that students do not often associate with academics. Researchers believe that the inherent motivation of games can be used to create an enjoyable, easier, engaging and learner-centered method of teaching that is ultimately more effective than current approaches.

Advocates of digital game-based learning point to its capacity to engage students and the role it plays in teaching students to use current technology for academic purposes. A study conducted at Greece's University of Thessaly found that students who used a gaming application to learn course concepts were considerably more enthusiastic than their counterparts who used a traditional website to learn the material. The gaming group also recorded higher post-test scores

and reported their experience to be more engaging, effective and relaxed than those in the non-gaming group.

It is possible for games to be used as an *effective* educational tool because the learning process occurs within a meaningful context. Students learn material and use that knowledge to advance in the game. They are able to apply and practice what they have learned in the same environment in which they learned it. According to University of North Dakota Associate Professor Richard Van Eck, “Learning that occurs in meaningful and relevant contexts is more effective than learning that occurs outside of those contexts, as is the case with most formal instruction.”[1]

Although the model can have real impacts on student achievement and engagement, there are several potential drawbacks. These concerns should be considered when making a decision about whether to use games as part of the curriculum. Students are used to playing digital games that are multi-media rich, have in-depth storylines and clear goals. To meet expectations and maintain interest, it is important that the learning games share the same characteristics to the greatest extent possible. However, it is important to find a balance so that the complexity and attractiveness of the game does not distract from the intended lesson. It may also be difficult for teachers and school districts to design their own games. Fortunately, there are hundreds of apps and resources available online that cover all subjects and grade levels.

The global demand for digital learning games continues to grow as more schools discover the value of using them to supplement curriculum. As author Marc Prensky points out in his book *Digital Game-Based Learning*, “Digital games are now being used to teach babies the alphabet, to help kids monitor their diabetes and overcome ADD, to teach both practical and tactical skills to the military, to teach financial derivatives to auditors and to teach CAD software to engineers among other things. And this is just the beginning- ANYTHING can be taught more effectively through Digital Game-Based Learning.”[2] The method’s growing use and acceptance suggests that it has a bright future in K-12 classrooms.

[1] Eck, R. V. Digital Game-Based Learning: It's Not Just the Digital Natives Who Are Restless. EDUCAUSE Review, 41. Retrieved July 23, 2014, from http://edergbl.pbworks.com/w/file/fetch/47991237/digital%20game%20based%20learning%202006.pdf

[2] Prensky, M. (2007). Digital Game-Based Learning. : Paragon House. (Original work published 2001)

Technology in the Classroom

In the spirit of this discussion, we have gathered four pieces of research and literature.

- Flipped Learning Model Dramatically Improves Course Pass Rate for At-Risk Students" is a case study presented by Foundations of Flipped Learning and Pearson Education, Inc. It focuses on a low-performing high school near Detroit, Michigan and the impact that applying a completely "flipped" classroom model had on student achievement, course completion and graduation rates.

- "Bring Your Own Device (BYOD) for Seamless Science Inquiry: A case study in a Primary School" examines the effect that a Bring Your Own Device model has on student engagement and content knowledge. The authors recognize the unique capabilities offered by digital devices to enhance student learning and what role the devices play in a student's understanding of subject matter.

- "Examining the Influence of a Mobile Learning Intervention on Third Grade Math Achievement" is a 2012 study from the Journal of Research on Technology in Education. The authors aim to determine what effect using iPads to teach multiplication has on student achievement versus more traditional methods of instruction.

- "Digital Game-Based Learning in high school Computer Science education: Impact on educational effectiveness and student motivation" examines how computer games can be used as educational tools. The author expands on what elements make the games attractive to students and what effect game-based learning has on student achievement and engagement.

Flipped Learning Model Dramatically Improves Course Pass Rate for At-Risk Students

A case study presented by Foundations of Flipped Learning and Pearson Education, Inc.

Michigan's Clintondale high school is the nation's first completely "flipped" classroom school. Located north of Detroit, the school serves mostly low-income students, three-quarters of whom are African American.

During the 2009-2010 school year, half of Clintondale's freshman class was failing English, math and science. The school was ranked among the worst 5% in Michigan and Principal Greg Green recognized the urgent need to change the way at-risk students were being educated. After testing the flipped model in one ninth grade social studies class, Green made the move to implement the model across all grade levels and subjects for the 2011-2012 school year. Teachers recorded their lectures and students watched them at home as their homework assignment. The video element allows students to rewind and re-watch the lesson as many times as needed to understand the material. Eighty-two percent of students used their own digital devices to view the lecture and any student who did not own a device was given extra time on school computers to watch the video(s). The following day, teachers worked with their

students on individual and group assignments based on the material covered in their video lecture.

Since lectures are viewed at home, the amount of one-on-one time teachers spend with the students has quadrupled. The teachers are able to get to know their students better, personalize their instruction and evaluations and improve their skills and subject mastery.

After implementing the flipped classroom approach, test scores, graduation rates, college attendance and student engagement have all improved. Discipline referrals have declined by 66%. Pass rates for the freshman class in the first flipped learning semester climbed to nearly 70% for English and math and to 80% for science and social studies. The graduation rate increased from 80% to 90% and college attendance went from 73% to 80%. Furthermore, pass rates on the 2012 Michigan Merit Exam increased in every subject among eleventh grade students.

Besides increasing academic performance, the model has made it easier to share classroom materials, keep students from falling behind when they are absent and ensure that curriculum remains consistent. Green also noted that parents often watch the lectures with their children creating a more educated and engaged community.

http://assets.pearsonschool.com/asset_mgr/current/201317/Clintondale_casestudy.pdf

Bring Your Own Device (BYOD) for Seamless Science Inquiry: A case study in a Primary School

By Yanjie Song and Cheuk Lun Alvin

The “Bring Your Own Device” (BYOD) model is becoming popular in classrooms. The personalized learning, continuous engagement and cost savings are attractive features to many schools. This Hong Kong Institute of Education study focused on a sixth grade class learning about the anatomy of fish. It was designed to understand how students furthered their content knowledge in a seamless learning environment supported by their own mobile devices.

Twenty-four of the students used their own mobile devices (tablets or smartphones). The remaining four students used school-owned iPads. The devices allowed the students to take photos, videos, record audio and access the Internet. Three mobile apps were used to supplement their learning experience: 1) Edmodo- a social network platform used for students to communicate, share information, submit assignments and organize activities, 2) Evernote- free software designed for note-taking and 3) Skitch- an app used to annotate images.

Students were first exposed to material on fish anatomy through classroom and lab activities. They were then required to complete assignments using their mobile devices outside of school. They viewed websites and shared their findings with classmates on Edmodo, visited the wet fish market and took pictures to upload to Edmodo and labeled the different fish body parts on a photo taken during the lab session using Skitch.

Prior to the lesson, pre-test answers focused on basics (fish live in water, we eat fish, etc). After the study, both test answers and concept maps were more focused on fish anatomy, the

functions of the body parts and their proper relationships. To identify the role that mobile devices played in performance on the post-test, researchers traced the development of students' digital artifacts and how the groups worked together to refine and expand upon shared information. They discovered that the mobile devices played a significant role in students' knowledge content and understanding.

Mobile devices allowed students to gain information beyond what was available in textbooks. The ability to share information anytime, anywhere in real time while using personal devices gave them a sense of ownership over their own learning.

http://icce2013bali.org/datacenter/mainconferenceproceedingsforindividualdownload/c7/C7-f-194.pdf

Examining the Influence of a Mobile Learning Intervention on Third Grade Math Achievement

By Derick Kiger, Dani Herro and Deb Prunty

The widespread use of mobile devices among students has prompted schools to reexamine how they might be used to improve instructional and operational practices. This 2012 Journal of Research on Technology in Education study focused on four third grade classrooms at a Midwestern elementary school. Researchers wanted to understand how a mobile learning intervention (MLI) might affect student achievement in learning multiplication.

Two classrooms used the Everyday Math (EM) approach and daily practice with flash cards for multiplication practice. The other two classrooms paired EM and daily practice using pre-loaded math apps on an iPod touch device provided by the school district at a cost of $252 per pupil. Students practiced for ten minutes each day and the teaching of multiplication facts remained consistent across all classrooms. On certain days, the teachers would assign specific multiplication tables to focus on. Other days, students were free to select any app (in the two MLI classrooms) or method (in the two traditional approach classrooms) that they wanted.

Researchers discovered that not only were the children in the two MLI classrooms more engaged with the lesson, but they often self-selected multiplication tables for numbers that they did not know well. When compared to a pre-study assessment, the students in the MLI classrooms answered more problems correctly on a post-assessment than their fellow students who used traditional methods. Further analysis revealed that the mobile learning intervention, student demographics and advanced teacher training played significant roles in answer accuracy of the most difficult problems on the post-assessment.

Pairing traditional curriculum with a mobile device may be a cost-effective way to improve student achievement versus costlier technology models like one-to-one laptop programs. In addition, in-class mobile learning may support productive student-teacher learning interactions and bolster student engagement.

http://files.eric.ed.gov/fulltext/EJ991839.pdf

Digital Game-Based Learning in high school Computer Science education: Impact on educational effectiveness and student motivation

By Marina Papastergiou

This study was conducted through the University of Thessaly among 88 students in a Greek high school Computer Science course. The aim was to assess the learning effectiveness and motivational appeal of a game created to teach computer memory concepts versus a traditional website. Both covered the same learning objectives and content.

The gaming application included attractive elements that are present in many games played by students outside of school. These included: set rules, challenging goals, fantasy linked to student activity, progressively difficult levels of play, high degree of student control , uncertain outcomes and immediate and constructive feedback. To advance, students had to make their way through maze by answering questions, solving problems and examining media content as it was presented to them. They had opportunities to earn extra points and lives and an immediate explanation was given for any incorrect answers. A flag would be collected in each room they successfully navigated. Once three flags had been collected, the game would end. The non-gaming application used by a second group of students included the same content, but was presented in website form with an interactive quiz at the end of the lesson.

Opposite of the non-gaming group, the students in the gaming group seemed very enthusiastic about the lesson. They remained engaged throughout in an effort to achieve a high score and complete the game. The author discovered that the students who had used the gaming application had higher post-test scores than those who did not despite both groups having similar prior knowledge and out-of-school gaming use. Students in the gaming group also expressed that their experience was more engaging, effective and relaxed than those in the non-gaming group.

The author argues that digital game-based learning can be used to improve student knowledge while supporting student enjoyment and engagement. Based on recommendations from the students, she also suggests that digital learning games should bear the same multimedia-rich adventurous characteristics of the games played by students outside of school to meet their expectations and retain interest.

https://www.cs.auckland.ac.nz/courses/compsci747s2c/lectures/paul/GameBasedLearning_CSEducation.pdf

The articles below showcase how school districts in Washington are incorporating technology into their classrooms.

Bring Your Own Device, It's Okay

Columbia Virtual Academy brings the school to the student

Comcast and Kent School District Showcase Technology in the Classroom at annual Tech Expo

Highline students earn digital badges

iPads bring on-the-fly instruction to Battle Ground schools

One-to-One Technology Rolls Out

Spanaway Lake High School students speak at Blended Learning Symposium at PLU

Vancouver Hosts NSBA Technology Site Visit

Washington School District Unwires the Classroom Experience

Washougal School District: Powerful Tools for Classroom Learning

What is Blended Learning?

These articles offer a different perspective and critiques of the flipped learning approach.

10 Pros And Cons Of A Flipped Classroom

Five Reasons I'm Not Flipping Over The Flipped Classroom

Flipped Learning: A Response To Five Common Criticisms

Still in Favor of the Flip

The Flipped Classroom: Pro and Con