The Roles of Innovation and Technology in Education

a white paper from the Virginia Society for Technology in Education (www.vste.org)

Innovation gives students/faculty a chance to show their creativity and originality.
— Debra Quesenberry, Patrick County Public Schools

Public education continues to be an evolving experiment, and without innovation our learners will not be globally competitive.
— John Sylvester, Buckingham County Public Schools

The Virginia Society for Technology in Education (VSTE) is a professional organization that serves the needs and interests of teachers, school administrators, and education partners within the Commonwealth of Virginia and beyond. As an affiliate of the International Society for Technology in Education (ISTE), we took their model of the special interest group and in 2009 formed the *Innovations SIG*. We asked our membership about their ideas on innovation in education. This white paper reflects some of the many ideas they shared with us.

What is innovation?

We live in a different world from the students.
— Norman Constantine, Wakefield School

Innovation means different things to different people. In the global marketplace, innovation means competitive advantages, streamlined production, and cost savings. In medicine, it might mean a new approach to curing a debilitating disease. Yet in education—something that has been taking place for almost as long as civilization has existed—what new, novel, or creative solutions have not already been tried?

Since the early 1980s when microcomputers emerged in classrooms across the United States, the use of computers in schools has been focused on three primary functions: drill and practice, assessment, and productivity. One exception to these are activities founded on constructionist theory. Dr. Seymour Papert from M.I.T. championed the use of computers to help students create their own personalized types of understanding. By programming a computer, students might engage in problem solving and creative, inventive thinking. When LOGO turtles made their way onto monitors in K-12 classrooms, it was seen as innovative, but also somewhat misunderstood.

Today, various facets of digital technology influence the way we work, communicate, and learn. The omnipresent role of technology in our lives today means technology alone in schools does not make it an innovative entity. Nevertheless, **VSTE's Innovations SIG**

believes that there is potential for innovation through the utilization of technology in education. Despite the rapid innovations that technology provides us outside of school, instructional practices remain largely unchanged over the past 100 years.

Just because something's been around for a while doesn't mean it is good. There is always room to grow and improve. Innovation makes school relevant to students, and makes students relevant to employers.
— Bea Cantor, Goochland County Public Schools

While there is debate on how to compare students between states and likewise between countries, one particular test is often cited to make comparisons. In 2006, 57 different education systems across the globe participated in the Program for International Student Assessment (PISA). On average, "U.S. students scored lower than the OECD average on the combined science literacy scale," being lower than 22 other education systems. For mathematics, the U.S. was lower than 31 other education systems (http://www.nces.ed.gov/surveys/PISA/pisa2006highlights.asp). A sampling of countries bettering the U.S. in math, for instance, include: Finland, Korea, Switzerland, Canada, Japan, German, France, and the United Kingdom (http://nces.ed.gov/pubs2008/2008016.pdf).

Another test used to compare student data in science and mathematics internationally is the Trends in International Mathematics and Science Study (TIMSS). While the PISA exam compares students at age 15, the TIMSS compares students at two grade levels: grade 4 and grade 8. The U.S. on average scored at 529 (29 points above average) in the 2007 study in mathematics at grade 4 and 508 by grade 8. Countries scoring higher at both grade levels include Hong Kong, Taiwan, Singapore, Japan, and England. In Science, the U.S. was once again bettered by the some of the same countries: Singapore, Taiwan, Hong Kong, Japan, and England (http://nces.ed.gov/pubs2009/2009001.pdf). While this not a measure of a student's ability with technology, STEM is an area of focus in global competitiveness and an area where the U.S. Department of Education and other entities have placed much focus since 1996. (http://www.stemedcoalition.org/).

Because of the performance of American students on the PISA and TIMSS, many folks today see the American education system slipping. Those familiar with the concept of globalization know that innovations in business mean your co-worker today could be someone who lives in another state, or another country. Businesses that operate globally put manufacturing in places where they find the cheapest labor, yet innovative ideas know no boundaries. Innovative thinkers and problem-solvers will rule in the next economy. Innovation may play a role in not only keeping our children today globally competitive in the future, but also globally competent.

Manorama Talaiver of Longwood University tells us this: "In order for the U.S. to be the global leader in invention, all children and educators have to understand and implement all kinds of innovation in classrooms—innovative tools, innovative practices, innovative

dissemination and communication. The concept of innovation should be inculcated as a spirit in every walk of life." Her sentiment—that innovation must affect both teachers and students—is echoed by Norman Constantine: "Schools must change as the world changes. Technology affects different generations in different ways and with the rapid change of things in 21st century, [it seems that] teachers and students are almost from two different universes."

"The world continues to change (and at an ever-increasing pace)," notes Bob Kolvoord of James Madison University. He tells us, "The only way for our society to keep pace is for education to innovate. People from 100 years ago would recognize little in today's world, yet teachers from 100 years ago would recognize much in today's classrooms. Sadly, there is no choice but to keep innovating, the consequences of not doing so are dire."

Some educators are convinced that educational practices need revision based on the premise that students today are different. We cannot deny students today live in a different world than many of our baby boomer teachers did when they were in school. It's flooded with media and dozens of ways to communicate. Brenda Taylor of Hampton City Schools says "Students do not learn the same way we teachers did when we were students. Innovation will help teachers stay in tune with modern students and their needs."

But what would this innovation look like? One SIG member told us: "Innovation can be thought of as the 'lifeblood' of classroom engagement and student motivation. Innovation via technology resources, hands-on manipulatives, visual representations, even special speakers and events can drive students to excel where they otherwise would be claiming boredom, or worse." Brenda Taylor insists that students today are technology "natives." "They have always had it and we need to use it to teach them effectively."

There's no doubt that problems plague our education system today. We are not suggesting there's a one-cure solution. But why does technology offer such a compelling hope when it comes to trying to be innovative? "Innovation encourages creativity and promotes new ways to teach and to learn. Innovation forces faculty to think about new ways of delivering content and engaging their students," says Mane Pada of the College of William and Mary.

When speaking about innovation, so many of our members mentioned concepts like "creativity," "originality," and "change." But they also told us innovation plays a role in simply meeting the needs of today's students.

What are examples of innovative practices taking place in Virginia schools today?

Some educators view innovation through the lens of the types of tools that have become available in their buildings. In the Wakefield School, for instance, they are using Google Apps, a Web 2.0 productivity suite. This innovative tool allows both teachers and students

to extend their capabilities by sharing documents, collaborating together, and to communicate electronically.

Many of our SIG members have seen the emergence of interactive white boards (IWBs) from vendors like Smart Technologies and Promethean as essential new tools in the twenty-first century. These tools allow for the presentation of information, which is not new. But they also encourage student participation through hands-on activities and through response systems that keep students engaged and teachers informed about each student's learning progress.

Another tool that several schools are using is Skype, a telephony over IP application that now includes video transmission. But who might students communicate with? Matt Bell's students in Bedford County went global. "Recently we had a 9th grade high school class Skype a class of 9th graders in Kenya, Africa. While there was some bandwidth issues the impact was immeasurable. We later set up a blog for continued communication with both classes." Other educators are using Skype to stay in contact with homebound students using computers the school division have deployed.

Educators in Virginia (and around the world) are also tapping into the convenience of putting classroom materials in one place using a course management tool, even though they are seeing students face to face in a real classroom. John Brishcar from Warren County channeled his own innovative powers. He saw the Moodle (moodle.org) open source tool as instrumental in providing a learning space for students in addition to using other free software on donated laptops. He's using Moodle to provide "an online experience" for students even though they are not connecting directly to the Web. Moodle is also being used as a medium for training teachers.

Ellen Guidry of Goochland County uses Moodle as a platform for delivering instruction to elementary teachers on word study and literacy with a course she designed. John Hendron, who manages the server in Goochland, says "the use of this tool with teachers *as students* is in itself innovative. When teachers see the potential of a tool like this in their role as a student, they are then prepared to start adapting this tool for use with their students." The online learning special interest group of ISTE (SIGOL) recently recognized educators in Goochland for their use of Moodle with elementary students for its ability to encourage collaboration between students in its elementary schools with an online learning award.

Papert's ideas about constructionism are still alive today, and well we might add, in some of Virginia's schools. Students in Hopewell, Virginia are staying engaged through a rollout of projects centered around robotics and children's engineering. They're also using Alice, a 3D programming environment from Carnegie Mellon University in Pittsburgh, to explore the creation of games.

In Hanover County, they like using technology to learn more about the world around them. They are pioneering the use of global positioning satellite technologies (GPS) to deliver lessons in geography, math, and history. GPS and Google Earth are tools we can see students utilizing in Patrick County, according to Debra Quesenberry. She tells us that a lot of different technologies are coming together, including Skype video chats and online wikis, to create a "Survivor SOL Challenge" for fourth grade students. Quesenberry likes using off-the-shelf technology like Flip-brand video cameras with students. But can students create and innovate with professional-level tools too?

Students in a 3D Visualization class at Goochland High School are using Google SketchUp (a tool originally designed for, and used today by architects) to model buildings in the courthouse area, including Goochland's historic courthouse using textures students collected using digital cameras. Student's tapped into their math skills to determine the dimensions of the buildings before submitting them to Google's 3D warehouse. Today, global visitors to Goochland through Google's Earth application will see these accurate models the students created.

3D environments are not just for high school students! Mane Pada reports that "a professor in our School of Law has ventured (the only faculty I am aware is doing this) into Second Life. She teaches her students about crime in the Internet and virtual worlds by actually going there with her class to meet with chiefs of police who explain and discuss crime in Second Life and also describe how it may/does transfer into 'first life.'" Manorama Talaiver, who leads the Institute for Teaching Through Technology and Innovative Practices (ITTIP) at Longwood, is interested in exploring Second Life for the dissemination of information and for a virtual brand of tourism. Beyond Second Life, Talaiver also wishes to educate school divisions in Virginia about the virtues of cloud computing.

Beyond the merits of cloud computing, we asked educators in Virginia what they wagered were the innovative tools, among those readily available. There are many reasons why educators chose these tools. As an organization focused on professional development, one of VSTE's goals is to demonstrate and share how these tools can lead to innovative learning.

- cellphones
- educational gaming (both student-created games and games created for students)
- GoogleApps
- GPS and geocaching with spatial data display software
- interactive white boards
- iPod Touch
- Moodle
- netbook computers
- podcasting and media production (Animoto, PrimaryAccess)

- probeware
- programming environment software: Lego WeDo, Scratch (scratch.mit.edu), Alice (URL), StarLogoTNG
- robotics
- slate computers (iPad)
- student response systems
- table computers (SMART Table, Microsoft Surface)
- three-dimensional printers
- video/movie production

What we saw in our research was that many of these tools are in use in schools across Virginia, but at significantly lower rates than what is needed. **Something is standing in the way of schools adopting innovative tools.**

What are the barriers to innovation?

Technology is integral to innovation. The world relies more and more on technology and it is our responsibility as educators to understand the technology and then share our knowledge with tomorrow's leaders.
— Luann Smith, Portsmouth Public Schools

Innovation incites change, and changing the way we do things will always be a challenge. We were interested in identifying, however, the barriers which stand in the way for Virginia's educators with regards to innovation. Every educator who responded to our survey identified innovative practices taking place in their location. Yet they were vociferous about two particular barriers, despite the successes they may have had: time and money.

Michelle Wright was one educator who voiced the opinions of many: "Resources and funding are one of the biggest issues faced. It affects being able to purchase needed technologies and provide professional development and support." While having the technology by itself is no guarantee that innovation will take place within a school, it is a necessary ingredient for providing access to the same class of tools being used in the real world. Professional development often addresses two needs once you have the tools: how to use the tools, and then how to use the tools in instructionally sound ways with students.

Katie Knapp from Virginia Beach Public Schools demonstrated to us that even when professional development is offered by a school or division, it's a tough sell in today's education culture to get people there. "Our biggest challenge is the time needed for training and learning the new technology. Schedules are so slam-packed, both at home and at work, we are finding attendance at training sessions much lower than that of sessions just a few years ago."

While innovation fits like a glove around technology, it is professional development efforts that drive the teaching and learning initiatives that can spawn innovation once teachers have arrived to a school. While efforts have always focused on using the technologies available in schools, recently trends have shifted beyond the use of tools and instead upon what students can do with them. VSTE has partnered with the Partnership for 21st Century Skills, a national clearinghouse of resources and ideas behind twenty-first century skills in education. The skill sets identified by this organization are valuable, we feel, because they have been born from authentic needs in today's workforce.

Why should we innovate in our school?

We think Matt Bell from Bedford County Schools sums it up well: "Technology brings basic curriculum to life for today's 21st century learners." The means by which we do that is changing. Technology is changing. If we look carefully enough, we'll see that life is changing.

Technology today empowers students to collaborate in ways that were impossible just ten years ago. Technology is behind the so-called "flattening" of the world, to borrow Thomas Friedman's lexicon, which opens up opportunities for students to both deepen and broaden their understanding of the world and its place in the universe. Technology provides a dynamic platform for inventive, creative learning opportunities that teach students how to problem-solve. Lastly, technology also widens the opportunities in today's schools for enhanced productivity and access to authentic learning experiences.

The VSTE Innovations SIG is passionate about exploring innovations in teaching and learning with technology in Virginia's schools. We share a passion born from our own positive experiences at seeing the impact innovative approaches have with students. Teachers are taking advantage of the technologies specially-built for the educational arena (Interwrite tablets, Promethean boards, and the Discovery Educator's Network to name a few) but they are also adopting the same tools you will find on an electronics store shelf or in the workplace to meet the needs of today's children.

We are advocating to overcome the barriers that stand in the way of innovating in education. Beyond the funding and time issues we have articulated in this paper, our membership also recognizes the attitudinal changes needed to buoy innovation in schools. Being innovative requires from us the qualities of flexibility, open communication, mobility, and malleability in our tools and our attitudes. We wish you well on this endeavor and hope that you would consider VSTE to be a partner on your journey towards innovation in education with technology.

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