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Best Practices for Technology Integration

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Honor Pledge: I have neither given nor received any help on this paper. AMR.
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Introduction

"Technology-enhanced items" were introduced to an eighth grade class I observed preparing for their annual standards of learning (SOL) test. By "technology-enhanced items," the test was describing a series of click-and-drag question and answer choices that would be included on the test. For some students, this is the extent to which they have interacted with new technologies. As educators, we have to stop and think: is this an adequate amount of exposure to new technology products for our students to be successful in the 21st century workforce? Are we, as educators, continuing to implement "best practices" in the general education classroom through these essential new technology products? Are these practices meeting the needs of all of our students, including our gifted students?

Technology integration in the classroom is constantly changing according to new technology products and innovative uses in the educational setting. Teachers are trying to catch up with their students' almost innate knowledge of new forms of technology; the "digital native" generation is quickly outpacing most educators in their 21st century skills (Prensky, 2001). If general education students are already outpacing educators, what about our gifted education students? The Computer and Technology Network of the National Association for Gifted Children (NAGC) states the following mission on their website, "it is the commitment of the Network to initiate, develop, and implement practices and materials that will promote the use of all types of information technology to improve the teaching and learning process," (NAGC, 2013). NAGC states the essential obligation to meet gifted students' needs through implementing new forms of educational technology.

"Best teaching practices" can also be applied to the constantly changing educational technology field (Dunn, Wilson, Freeman & Stowell, 2011). These "best practices," such as the

Technology Integration Standards Configuration Matrix, can be used by the teacher to effectively differentiate the curriculum to meet their students' needs (Mills & Tincher, 2003). Teachers should be teaching using the technology to implement “best practices” rather than focusing the lesson on the new technology product.

Research Questions

1. What are “best practices” for integrating technology into the general education curriculum?
2. How can educational technology best meet gifted students’ needs?
3. What new and developing technologies can teachers implement to best meet the needs of 21st century learners?

Literature Review

Best Teaching Practices Applied to Teaching Technology Skills

In order to successfully implement new technologies into the classroom, evidence-based teaching practices need to be considered and integrated into each lesson. Evidence-based practices in education, or educational interventions found effective by current research, can help guide teachers to choose best teaching practices in their classrooms (Bloom, Fischer, & Orne, 2009). Common best practices of teaching can easily be applied to any new form of technology; for example, authentic learning can easily be transferred to online-based tasks. Authentic tasks—tasks that consist of active, inquiry-oriented learning created by students, rather than teachers—are one example of an evidence-based best teaching practice (Israel, Maynard, & Williamson, 2013). An authentic task example can involve classes that pick a local charity to construct downloadable pamphlets for English classes and compile statistics through Google Fusion Tables; these assignments create interdisciplinary tasks that emphasize 21st century skills.

Twenty-first century skills include critical thinking, problem solving, communication and collaboration (Partnership for 21st Century Skills, 2009). There are several collections of best practices of teaching, but the three most applicable are Chickering and Gamson's (1999) *Seven Principles of Good Practice*, the Technology Integration Standards Configuration Matrix (TISCM), (Millers & Tincher, 2003), and the National Educational Technology Standards (NETS), (International Society for Technology in Education, 2012).

Chickering and Gamson's (1999) *Seven Principles of Good Practice* consist of the following principles: frequent student-teacher contact, cooperation among students, active learning, prompt feedback, emphasis of time on task, communication of high expectations, and being respectful of diverse ways of learning and talents. These principles can be applied to teaching with technology; students are not just given computers and asked to create a new project without any previously set expectations. The active learning component is especially important in how students will complete their learning experiences. These small group activities consist of students creating a new product by applying knowledge learned and teaching other members of their group how to complete the task. These students are using the highest level of Bloom's revised taxonomy: creation (Krathwohl, 2002).

In addition to these seven principles of best teaching practice, there is a set of teaching standards specific to teaching with technology, the Technology Integration Standards Configuration Matrix (Mills & Tincher, 2003). The reason for creating these standards was to implement professional development exercises for teachers, having them model and teach through the technology, rather than simply implementing occasional technology exercises (Mills & Tincher, 2003). Teachers all have different backgrounds in technology; therefore, they go through a series of technology fluency stages: entry, adoption, adaptation, appropriation, and invention (Sandholtz, Ringstaff, & Dwyer, 1997). The TISCM matrix is based on these fluency stages, technology standards, and indicators of a professional development model for evaluation of technology integration (Mills & Tincher, 2003). The technology standards of the TISCM were based on a developmental model and are divided up into a series of developmental phases of technology integration: Phase One uses technology as a tool for professional development (Standards 1-6), Phase Two monitors and delivers technology instruction (Standards 7-12), and Phase Three directly integrates technology into student learning (Standards 13-18), (Mills & Tincher, 2003). The TISCM can easily be applied to a wide vary of new and emerging technologies in the classroom setting.

In addition to the TISCM, the International Society of Technology in Education (ISTE) developed the National Educational Technology Standards (NETS), standards that select best practices in learning, teaching and leading with technology in education (ISTE, 2012). ISTE developed NETS for students, educators, administrators, coaches, and computer science educators (ISTE, 2012). For teachers, there are five main sets of best practices with several subcategories for advancing digital age teaching: 1) facilitate student learning and creativity, 2) design and develop digital-age learning experiences and assessments, 3) model digital learning, 4) promote and model appropriate digital citizenship, and 5) engage in professional development and leadership (ISTE, 2012). Therefore, you have to not only have students complete 21st century tasks, you need to model and demonstrate that you are also a 21st century learner by learning new technology practices in education.

When implementing best practices, it is important to incorporate technology use throughout the curriculum, rather than with a few lesson plan activities. In order for successful technology implementation, teachers cannot simply attend isolated instances of technology professional development; they need reliable, everyday support from their technology department. Teachers need to think of the technology as serving various functions versus application, a process versus an approach (Mills & Tincher, 2003). Teachers will advance through the TISCM technology fluency stages by having technology professional development opportunities within regular school meetings. Therefore, teachers would have more opportunities to explore new forms of technology, while still having support from technology department staff.

Meeting Gifted Students' Needs through Educational Technology

Characteristics of gifted students. In order to meet the needs of our gifted students, we must first determine what specific traits characterize and distinguish them from general education students. Renzulli's three-ring model of giftedness focuses on three main traits: above average ability, high level of task commitment and high level of creativity (Renzulli, 2012). Even though not all gifted students are identical, there are general characteristics—including those three sets of traits mentioned—that can be used to help identify gifted students whose needs are not met by the general education curriculum. Some of the specified positive characteristics of gifted students are the following: early and rapid learning, superior analytic ability, academic superiority, advanced interests, task-oriented, strong sense of social justice, and diverse interests (Davis, Rimm, & Siegle, 2011). For example, a gifted student might develop an intense interest in astronomy and advance easily in physics and mathematics classes. This student's needs—to learn new, abstract, challenging concepts—would not be met in a regular instructional paced mathematics class; providing additional work of the same previously mastered concept is not challenging to a gifted student. Instead, this student's needs could be met through curriculum compacting and acceleration in the specific subjects, which can be achieved through massive open online courses (MOOCs), (Renzulli, Smith & Reis, 1982; Educause Learning Initiative, 2013).

There are also some negative characteristics of gifted students: interpersonal difficulties, underachievement in uninteresting areas, extreme perfectionism, excessive self-criticism, and poor self-image (Davis et al., 2011). These characteristics need to be addressed in a classroom with gifted students: if they are not addressed, gifted students could develop socio-emotional difficulties, or even drop out of high school due to lack of a challenging academic environment (Davis et al., 2011). Studies of students who drop out of high school estimate that between 18% and 25% are in the gifted range of abilities (Renzulli & Park, 2000). Some of these negative characteristics can easily be addressed by new forms of technology: online forums can provide a community of support as students complete MOOCs (Educause Learning Initiative, 2013). In addition, new open-source online communities embrace mistakes rather than encourage perfectionism: the open-source model promotes collaboration and knowledge sharing through online users to create new, or improved, ideas (Nordin, Ibrahim, Hamzah, Embi, & Din, 2012).

Gifted students' needs and differentiation. Gifted learners have unique needs in acquiring these 21st century skills through technology integration (Sheffield, 2007). Gifted educators should work with general educators in order to effectively differentiate the curriculum according to their individual needs; a variety of strategies must be used in order to effectively differentiate the curriculum (Siegle, 2004). The “digital native” generation of gifted learners has unique needs and needs to be appropriately motivated and challenged by the curriculum (Prensky, 2001; Weber, 2006). By differentiating the educational technology curriculum implemented, teachers are not only supporting gifted students’ needs, but every student’s needs: teachers tailor the product, process and content according to each individual student’s needs.

Gifted students’ needs include the necessity of having teachers construct more complex, abstract subject content and accelerating instructional pace, or curriculum compacting (Renzulli, Smith & Reis, 1982; Weber & Smith, 2010). In addition, the teacher should present information in a way that clearly indicates what information is the most important (Weber & Smith, 2010). The process by which gifted students are taught should include a positive learning environment that supports a diversity of learning styles (Weber & Smith, 2010). Also, gifted students’ levels of perfectionism have been found to decrease within a rigorous academic environment (Prior, 2011). Therefore, it is important to adapt the product, process and content in response to students’ interests, learning styles and readiness to learn, or their zone of proximal development (Weber & Smith, 2010; Vygotsky, 2011).

Educators who address gifted students’ needs differentiate the curriculum so that gifted students are taught within their zones of proximal development (Vygotsky, 2011). The zone of proximal development is the distance between the level of the student’s actual development and the level of potential development (Vygotsky, 2011). This is determined by tasks solved by the student under the mentorship of the teacher, or under the mentorship of another individual who is at a higher developmental level than the student (Vygotsky, 2011).

There are a variety of new and emerging technologies that can easily help differentiate the curriculum according to each student's zone of proximal development. For example, massive online open courses (MOOCs) can target gifted students' needs by enabling them to interact with professors who specialize in their focused talent area. The main advantage of enrolling in MOOCs over structured college online courses is that MOOCs remove financial barriers for students: the courses are mostly free and require no textbooks (Educause Learning Initiative, 2013). MOOCs give online users, including gifted students, open access to courses taught at prestigious universities. Two universities—Massachusetts Institute of Technology and Harvard—founded edX, a non-profit open course online platform to ensure free access to all online users (edX, 2013). These MOOCs provide extremely valuable resources for gifted students; gifted students are not restricted financially by taking these advanced courses. They can also discuss the content with their peers through online discussion forums, creating a community that meets their socio-emotional needs as well (Webb, 1994).

Gifted educators, and general educators who teach gifted students, have an obligation to meet the needs of their students by integrating best practices of teaching into the technology education curriculum. By integrating technology into the curriculum, differentiation is made possible by providing a strategy that benefits not only gifted students, but all students being taught. Every student is taught 21st century skills when educators abide by the TISCM and NETS standards. Other teaching best practices, such as Chickering and Gamson's (1999) *Seven Principles of Good Practice*, can be applied to technology education as well. Gifted students need to be challenged in their zone of proximal development, and through the use of differentiating through new methods of technology, educators can help to better meet the needs of their gifted students.

New and Emerging Technologies Meeting 21st Century Learners' Needs

The first wave of information technology emphasized students learning computer technical skills, while the second wave focused on the pedagogical theories behind the new information technology and application of skills (Adams & Morgan, 2007). This second wave helps teachers apply best teaching practices by implementing 21st century skills. In order to teach 21st century skills, there is a new collaborative model—the open-source model—that promotes the social principle of knowledge sharing, learning and developing new skills (Nordin et al., 2012). The open-source model easily aides itself to teaching collaboration skills through open-source software; this software builds upon collaboration by any online user and is available for free online. Some examples of open-source software are MIT's OpenCourseWare, online massive open online courses (e.g., edX), Thingiverse for 3-D printing, and Khan Academy.

Cooperation in small group activities achieves a new level in the open-source model: students have the ability to collaborate with any online user to create new products (Nordin et al., 2012). Teachers could assign small groups of students with creating new, or improved, 3-D designs to add on to Thingiverse for 3-D printing purposes. Thingiverse is a website created by MakerBot—the main company that produces 3-D printers—for sharing, discovering, and collaborating digital designs to be printed with 3-D printers (MakerBot, 2012). These digital designs can be uploaded from Thingiverse to be printed or students can create their own designs through other free web design programs (e.g., 3Dtin.com). Students can also upload designs from Thingiverse and make them more efficient, or just creatively different, to be added onto Thingiverse as different versions of the original (MakerBot, 2012).

With these authentic tasks, students will be more engaged and motivated in each class lesson. Authentic tasks—tasks that promote problem-based learning, computer-supported collaboration, and student-centered learning—create a more effective, long-term learning environment for students to develop various 21st century skills (Herrington, Reeves & Oliver, 2006). During authentic activities, every student can be assigned a different role in a small group; this capitalizes on students' strengths, rather than their weaknesses. This practice of differentiation benefits all students by reaching students at their appropriate zone of proximal development (Vygotsky, 2011).

Another form of the open-source model is available online through Khan Academy. Khan Academy is committed to providing educational resources available to any online user: they have published a series of online lectures that are used in conjunction with the flipped classroom model (Khan Academy, 2013). The flipped classroom model consists of teachers recording the content material and assigning them as homework; class time focuses on the application of the concepts learned through the assigned videos (Gerstein, 2011). Opponents of the flipped classroom model state that there are two major obstacles: students coming to class unprepared due to lack of resources and finding high-quality videos that are appropriate to the unit content (Herreid & Schiller, 2013). Even though these challenges may be present, there are an increasing amount of supportive networks that share flipped classroom videos, including the Flipped Classroom Network (Flipped Learning Network, 2013). This network, which has over 13,000 users, aims to create an online community that promotes the flipped classroom model by supporting teachers who use the model in their classroom (Flipped Learning Network, 2013). The flipped classroom model is an attractive model to many teachers by engaging their students in a fun new way to learn. The model also lends itself easily to differentiation: students at home can replay the videos as many times as needed, taking as long as needed to learn the concepts. By using the flipped classroom model, students spend most of their time in class again using Bloom's highest level of revised taxonomy—creation—by applying concepts learned to create a new product (Krathwohl, 2002).

Conclusion

There are a number of best practices for integrating technology into the curriculum. It is important to know the needs of the students in every classroom and choose the appropriate evidence-based best teaching practices. Technology is constantly changing, but best teaching practices can be applied to an ever-changing field of instructional technology. Teachers need to integrate technology seamlessly into the curriculum so that students can view an appropriate model of technology use. Many educational technology products are easily used with best teaching practices, such as differentiation, in which the needs of all students are met—including gifted students. Gifted students can be appropriately challenged in their zone of proximal development through MOOCs taught by professors, among other technology programs. For example, the open-source model of collaboration provides many opportunities for gifted students to add to the level of scholarship (e.g., Thingiverse with 3-D printing). Through this model, all students learn the 21st century skills needed to become successful 21st century citizens.

Introduction to Practical Application

The website *Gifted Collaboration* (i.e., http://giftedcollab.umwblogs.org/) was designed as an open-source form of collaboration for gifted educators. This website was based upon the idea that all students, including gifted students, must learn 21st century skills in order to become more successful in the 21st century workforce. In order to successfully model these 21st century skills, gifted educators need to collaborate with each other and constantly learn new technology forms, helping to add and create new ideas for a new open-source online pedagogy. This website consists of several subpages that focus on different means of sharing gifted education ideas. The first main subpage, the Gifted Open-Source Teachers Exchange, focuses on a series of lesson plans that can be uploaded through various means (e.g., Google Docs, websites, etc.). The second subpage consists of various real-time tools for gifted educators to connect (e.g., Diigo group, Twitter chat, Google Docs). The third aspect of the website, which will be integrated through the side bar of the home page, will be a running feed of gifted educators' online blogs about gifted education. There are also subpages that explain the purpose of the website and some of my basic contact information.

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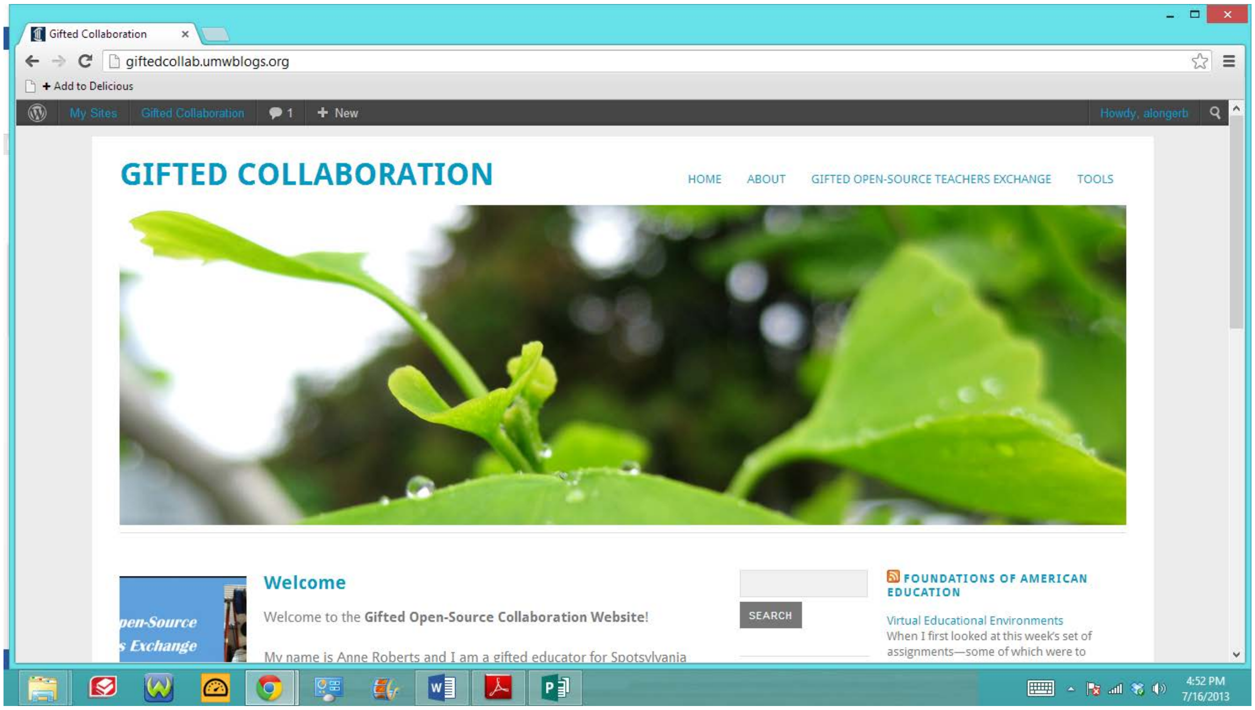
Practical Application: Gifted Open-Source Website

(http://giftedcollab.umwblogs.org/)



The gifted open-source website is based upon the open-source model, which promotes the social concept of knowledge sharing in order to develop new skills (Nordin et al, 2012). There are several teacher collaboration websites available, such as Classroom 2.0 or the Flipped Classroom Network, but they do not provide a simple method of uploading lesson and unit plans so that other users might easily download or edit the plans (Classroom 2.0, 2013; Flipped Learning Network, 2013). In order to truly provide open-source content, users of the designated website must be able to easily access the information and also be able to easily contribute to the increasing online library of targeted content. This website seeks to provide such open-source content in a similar manner to Thingiverse. Thingiverse has attractive preview pictures of each model intended to be printed by a 3-D printer (MakerBot, 2012). These models are easily accessed and downloaded for free by any online user; this creates an open-source model of sharing information among the MakerSpace community (i.e., community that uses 3-D printers), (MakerBot, 2012). The gifted open-source website intends to create a similar user-friendly database of teacher lesson plans that can be easily previewed, downloaded, and re-uploaded to the database with newer editions of the original lesson plans. Once teachers make revisions, they can also discuss their revisions in an open online Diigo forum and scheduled Twitter chats. Teachers can have the option to tag their blogs to the open-source website as well for more in-depth explanations of various lesson plans.

Gifted educators are also in the unique situation that they are usually the only teacher in their school: it is essential to create online communities for gifted educators to be able to effectively collaborate with each other. The gifted open-source website is dedicated to providing a resource that provides additional opportunities for gifted educators—regardless of proximity—to collaborate. A number of gifted educators in the past several years have established collaboration websites, but this website seeks to be one-stop shop for lesson plans, various blogs' feed, and an online forum to collaborate with other gifted educators.

This website will be continuously updated as more members join and add their blog feed and lesson plan ideas. This resource will be proposed as a personal learning network tool for gifted educators at a Professional Learning Community in Spotsylvania County Public Schools. Instead of sharing Google Docs or various websites, this can be a central location that can be used with other gifted educators in Spotsylvania County and other counties, or even countries. It will also be shared among the members of the Computer and Technology network of the National Association for Gifted Children through the online Facebook group. In addition, the Twitter chats will attract new members who are also interested in gifted education.

Additional Screenshots of the Website