TECHNOLOGY-INTEGRATED K-8 PROJECT-BASED LEARNING

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ABSTRACT

TECHNOLOGY-INTEGRATED K-8 PROJECT-BASED LEARNING

By:

Ashley LaPorte

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In order to produce higher student achievement and engagement, this project focuses on how K-8 educators can implement research-based curricula in which technology immersion and project-based learning (PBL) are integrated. Tech PBL for All (http://techpblforall.weebly.com) is a resource guide constructed from a successful model of technology-integrated PBL based on a comprehensive review of the literature. With the implementation of the Common Core State Standards, teachers have had to make many changes to their pedagogy. The Next Generation Science Standards (NGSS) are next in line for implementation and teachers need to be prepared for this major shift in what students are expected to know in relation to STEM (Science, Technology, Engineering, and Mathematics). This resource guide provides teachers with easy access to technology-integrated PBL resources that will lead them in creating a student-centered classroom that focuses on content knowledge in STEM while building students’ 21st century skills.
Keywords: technology, PBL, project-based learning, inquiry-based learning, computers, 21st century skills, STEM, engineering, science, Next Generation Science Standards (NGSS)
CHAPTER ONE: INTRODUCTION

Technology Integrated Project-Based Learning

Education is an ever-changing field. Not only do individual states strive to have students that are prepared for college, but there is a national need to bring our students into higher education and the work force with proficiency in academics. The United States has been falling short in academic progress compared to many other countries. This is in large part due to the inconsistencies among our states’ standards. Because of this decline, the state school chiefs and governors began an effort in 2009 to develop the Common Core State Standards (CCSS). This new set of national standards has already been widely adopted, with only a handful of states not yet on board. The idea behind the CCSS it to provide clear and consistent learning standards so that our students are able to graduate high school with the skills necessary to transition into college and careers regardless of where they live.

Another proactive effort to get our students on a level playing field with the rest of the world is the development of the Next Generation Science Standards (NGSS). The NGSS is similar to the CCSS in that it aims to provide science learning standards that are consistent nation-wide. The need for a new set of science standards came out of the realization that a large majority of American students are not prepared for success in a global economy. America is simply not on par with the rest of the world. This information is what drives decision makers to create standards that ensure the entire country is held at the same standards.
The NGSS provide an educational framework from which students can become an integral part of the modern workforce. Our country has lost its economic edge due to the decline in the scientific and technological literacy among its students.

Through scientific and engineering practices, crosscutting concepts, and a focus on disciplinary core ideas, the NGSS will ensure that students are prepared to become an innovative part of the future of the United States. With a focus on broad foundations of math and science this new set of standards will put our country back in the economic race for superiority in innovation and engineering.

With new information, global communication, and evolving perspectives, new standards have emerged with the result of curricula being redeveloped and new textbooks and eBooks published. This revolution is reflective of the reality that teachers are constantly adapting to societal trends and needs to reach their students in the best possible way. John Dewey, at the turn of the last century, promoted the idea of “learning by doing” as discussed in his work *My Pedagogical Creed* (1897). He believed that the teacher’s job is not to get students to subscribe to certain ideas or to get them to do things in the way the teacher believes appropriate. Instead, teachers should carefully choose the environmental influences, considering how they may affect the student, and guide them in how to handle the situation. Dewey (1897) believed that constructive activities are at the core of student understanding. This constructivist idea is also at the center of Jean Piaget’s theories, as well as the principles that have led to inquiry-based learning (Bruner, 1964) from which project-based learning (PBL) evolved. Research supports the assertion that students learn best by combining
knowing with doing. PBL not only allows students to learn in a multi-sensory way, but also improves students’ problem-solving capabilities and learning achievements (Chun-Ming, Gwo-Jen, & Iwen, 2012).

Although it has been proven that students learn very well in these constructivist environments, it is essential that teachers alter their pedagogy to accommodate a generation that is simply different. In a New York Times article entitled “Growing Up Digital, Wired for Distraction,” author Matt Richtel (2010) discusses research that suggests today’s children are beginning to have brains that are wired differently. A name given to this new generation, by world renowned writer and speaker on learning and education Marc Prensky, is Digital Natives (Prensky, 2001). Today’s children have always had technology at their fingertips. “It is now clear that, as a result of this ubiquitous environment and the sheer volume of their interactions with it, today’s students think and process information fundamentally differently from their predecessors.” (Prensky, 2001, pp. 2).

These Digital Natives simply cannot be expected to learn content the same way that us “Digital Immigrants” did. With students that are growing up in this digital world, it has become the teachers’ job, the Digital Immigrant, to change their way of teaching to accommodate the students. Teachers need to educate students within an environment in which they are engaged and “plugged in” to the content just as they are in every other facet of their lives. “Across the country, schools are equipping themselves with computers, Internet access and mobile devices so they can teach in the students’ technological territory” (Richtel, 2010,
para.8). Teachers need to change their methodology and learn the language and style in which the students communicate. Educators would not be replacing good thinking skills or changing the meaning of what is important for students to learn. Instead, they are just moving at a faster pace, allowing students to learn in more parallel learning environments instead of the step-by-step processes we are accustomed to (Prensky, 2001). This is where technology-integrated PBL comes in. This method of student-centered learning while utilizing technology addresses the learning style of today’s students. When students are given full access to technology, they are more engaged which leads to better school attendance and leaves less room for disciplinary problems (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011).

**The Project**

In considering the breadth of research done on the benefits of PBL as well as utilizing technology in the classroom, it is logical to conclude that using PBL integrated with technology will increase students’ STEM discipline performance in addition to keeping them engaged. This project provides a resource guide for teachers who seek optimal student learning outcomes through a technology-integrated PBL curriculum addressing STEM principles that is more dimensional than a traditional, lecture-based curriculum. The Five Dimensions of Teaching and Learning, developed by the University of Washington, is the instructional framework on which this curriculum is centered. The five dimensions are purpose, student engagement, curriculum and pedagogy, assessment for student...
learning, and classroom environment and culture. These core elements help implement high-quality instructional practices. The following objectives have been developed to assist elementary teachers in providing a rigorous, robust, and meaningful integrated STEM program for students. Specifically the guide will support teachers seeking to lead science, technology, engineering, and mathematics curricula in such a manner as to:

- Become aware of the effects of computer-supported, collaborative STEM learning formats on diverse student engagement and motivation-to-achieve in all aspects of STEM;
- Design and lead hands-on, minds-on integrated STEM activities that particularly enhance students’ understanding of and motivation to pursue inquiry across the curriculum;
- Utilize PBL principles along with technology to effectively enhance students’ attainment of Common Core’s 21st century skills: communication, collaboration, creativity, critical thinking, and problem solving.
CHAPTER TWO: LITERATURE REVIEW

Constructivist Theory

Often called the Modern Father of Experimental Education, John Dewey is considered one of the greatest educational thinkers of our time. He believed that education should be designed around a theory of experience. He was clear that this does not recommend total autonomy among students, but instead, a structured educational environment that lends itself to understanding concepts through doing. The classic and seminal work of John Dewey and cognitive theorist, Jean Piaget comprises the foundation of constructivist learning theory.

“I hear and I forget. I see and I remember. I do and I understand” is a popular saying that expresses the essence of constructivist learning. Psychologist Lev Vygotsky is known for his sociocultural theory. His theory was a major contributor to the development of the constructivist learning theory (Jaramillo, 1996). His belief in the development of higher cognitive functions of children through practical activity in social settings helped pave the way for what we now know as constructivism. Because of the large variety of contributors to the constructivist theory, it lends itself to a many different teaching styles. The idea of learning by doing is not a new idea, yet in many educational settings a teacher is found to be dependent upon the single dimension of direct instruction, lecturing to students while writing notes on the board for students to copy. There have been great strides taken in the development of pedagogy by many teachers in relation to student participation in more constructivist learning settings.
In their article “The Courage to Be Constructivist,” Brooks and Brooks (1999) clearly state why constructivist classrooms are required for authentic learning. “The search for understanding motivates students to learn. When students want to know more about an idea, a topic, or an entire discipline, they put more cognitive energy into classroom investigations and discussions and study more on their own” (Brooks & Brooks, 1999, para.20). This is something that every teacher wants. A student that is self-driven is one that does not need to be forced to learn, and in turn, enjoys learning. This article goes on to discuss some of the criticisms with this type of educational format. One criticism is that constructivism is too permissive, that students are being allowed to explore learning without much structure. This would undoubtedly be a problem. It could lead to chaos and a lack of coherence within the lesson. Another criticism is that a constructivist classroom lacks rigor. It is often believed that teachers sacrifice fact, information, and basic skills for the whimsy of discovery. The reality is that these criticisms come from those who are not well educated in the work that goes into creating a truly constructivist classroom that allows students to successfully understand concepts through structured and purposeful activities. Creating this type of classroom is not for the apathetic or laid-back teacher. It takes a dedicated, organized, and student-connected educator to successfully design this type of classroom. The expanding body of research about student acquisition of information supports this structure of learning. Brooks and Brooks (1999) go on to say that “State and local curriculums address what students learn.”
Constructivism…addresses how students learn. The constructivist teacher…blends the what with the how” (Brooks & Brooks, 1999, para.40).

However, the expansion into more dimensional, student-centered pedagogy that reflects constructivist learning theory and principles is not happening as quickly and uniformly as it should. While upper-elementary students are given some opportunities to participate in hands-on activities where they solve problems and work in collaborative teams, their engagement is insufficient. In many cases, teachers are found to be presenting curriculum using PBL, but because of their dependence upon traditional pedagogical structures and unfamiliarity with the collaborative and cognitive aspects of student engagement underlying PBL, they naturally provide more teacher-directed curricular experiences to their students. The latter pedagogical styles of teaching form the basis for the resource guide presented in this project. In order for teachers to be able to create classrooms with this kind of structure, it is imperative that they get adequate training and have resources available to them.

**Inquiry-Based Learning**

In a study conducted by Sun, Chee-Kit and Wenting (2014) it was found that a student-centered inquiry lesson is more desirable as it positively affects students’ conceptual understanding. Rather than providing general assistance about procedure and putting emphasis on correctness, the researchers concluded that a teacher’s effectiveness results from a focus on clarifying misconceptions and prompting students with challenging questions that more deeply engages
them in thinking about concepts. Another approach to teaching a more dimensional learning experience is for teachers to provide enhanced PBL learning environments. An enhanced learning environment would be one that provides students with structures embedded in the activity that allows for students to organize and express ideas within their collaborative group. This enhancement will help eliminate issues that may arise due to misunderstandings and miscommunications. A study by Chua, Yang, and Leo (2014) found that students perform better when exposed to enhanced PBL rather than traditional instruction. The researchers employed the use of graphic organizers such as mind maps, which enabled the cooperative learning groups to organize their ideas. Students also were encouraged to come up with analogies for the posed problem and then were “asked how the analogous situation can be utilized to solve problems or generate new innovative ideas” (Chua et al. 2014). Students were additionally led in round-table discussions in which they achieved more understanding that prevented subsequent arguments and disconnection with group members. The teaching styles within these studies became the basis for the experimental teaching style. The researchers indicated that the use of enhanced PBL-structured curricula will promote more student achievement in STEM.

**Computer Supported Collaborative Learning**

A learning environment in which children are comfortable allows for more success and engagement in the classroom. In “Growing Up Digital, Wired for Distraction,” author Matt Richtel (2010) found support from experts explaining
that because children are being exposed to electronic games and activities at younger ages, their brains are learning how to change tasks quickly, which is creating the inability to sustain their attention for very long. Handing a child a paper book is not as exciting as handing them a tablet with a story on it. In order to truly reach students, teachers need to provide the digital platforms on which the students are more engaged and interested. This is where the aspect of integrating technology comes into the project design for computer supported collaborative STEM curricula. If studies are showing that students learn and work better when utilizing technology, then it should be used in order to enhance the PBL experience in elementary schools.

Research done by Foley and Reveles (2014) shows us that steps are being taken to provide our students with the most appropriate and accessible curriculum possible. In this article we learn that a new type of science instruction is being developed. This Computer Supported Collaborative Science (CSCS) creates a “Connected Classroom” in which students build their 21st-century skills by integrating technology into science learning. A pedagogical approach that supports collaborative learning with the use of technology is exactly what teachers need to be using with our students. The Next Generation Science Standards (NGSS) and Common Core State Standards (CCSS) are moving instruction away from memorization and toward students applying knowledge and using critical thinking. CSCS is a teaching method that addresses the shift away from a teacher-centered classroom toward a student-centered classroom that emphasizes the importance of technology in the learning experience. Although the
focus of CSCS is on science, it is not limited to just that subject. The article describes “Five Principles of Instruction” that help teachers utilize the connected classroom. Through these five principles students share information online, teachers check students’ understanding often, data is pooled, data is analyzed, and students’ share and compare explanations. These principles can easily be adapted to any subject. Obviously “the success of the technology also depends on the ability of teachers to adapt increased technology use into their instruction” (Foley & Reveles 2014, para.3). This web-based resource guide will provide teachers with appropriate activities as well as informative links to technology-enhanced PBL.

In a study conducted by Shapley, Sheehan, Maloney, & Caranikas-Walker (2011), 21 treatment schools were given Technology Immersion grant money to provide teachers with laptops, instructional resources, and professional development. The effects of this complete technology immersion on economically disadvantaged students’ learning opportunities were positive. At the conclusion of the grant period, it was found that the treatment schools’ students actually matched the skills of the more affluent students in the study’s control schools. Although in terms of motivation, school attendance, and disciplinary action, students from the experimental group fared better than those in the control group, Shapley et al. (2011) suggested that the reading and mathematics achievement did not have a significant increase. From this study, the researcher concluded that the use of technology was a more important factor in student
engagement and discipline, rather than simply an increase in student comprehension.

Ching-Ting, Ming-Chaun, and Chin-Chung (2014) conducted a review of 87 articles whose focus was on studying how technologies influence young children’s learning to learn if it is indicative that technology has an overall positive influence on learning. They found that children as young as three were familiar with many technology aspects especially when making a video call. This tells us that children at very young ages are becoming proficient in their digital literacy and are even aware of the social etiquettes that go along with it. The results of their meta-analysis, though conditional, indicate that with older children outperforming younger ones, more progress is achieved when there is greater prior knowledge, and more computer access at home, which leads to better performance in reading and math. Ching-Ting et al. (2014) also reported that research shows increased engagement when adults are encouraging, providing a comfortable climate, and involving students in establishing their individual learning goals. By addressing these characteristics in the design of a teacher resource guide it is anticipated that teachers will become better able to apply technology principles to curricula and instruction advancing children’s STEM achievement.

Building upon key aspects of children’s digital literacy is dependent upon teacher knowledge of the roles various technologies play in the social and cultural constructs and perceptions of students’ capability to use computers, that is, their ‘computer self-esteem’ (Ching-Ting et al., 2014, p. 95). Teachers need to be
ready to receive students that are already proficient in technologies in a variety of ways. The next step in their pedagogical content knowledge (PCK) is to engage, motivate, and aid students in STEM achievement through CSCS-enhanced PBL curriculum.

**Technology-Integrated STEM PBL**

Many schools and districts around the world are beginning to take into account the surplus of research being done on the importance of PBL as well as the need for infusing educational models with technology. The study done by Sun et al. (2012) found that pedagogical beliefs of the teacher may have an “effect on student conceptual understanding.” Although this was the focus of the study, the subsequent results also indicated that the prescribed model of Collaborative Science Inquiry (CSI) with the integration of Information and Communications Technology (ICT) could improve students’ conceptual understanding. In addition, it was found that low ability students benefited greatly in their learning of abstract concepts. This research, along with the additional research in the literature review, is what drives the development of the subsequent resource guide website. By introducing a teaching model that encompasses PBL while integrating technology, the resource guide will provide teachers with the tools to achieve outcomes similar to those in the aforementioned study.

Research completed by Chun-Ming et al. (2012) in a Taiwanese Grade five classroom, was able to determine that a PBL model that utilizes digital storytelling as a way to synthesize ideas in a science classroom could effectively
enhance the problem-solving competence, academic achievement, and motivation of the students. Not only did they find that student outcomes were enhanced, but upon interviewing students at random “it was found that the students in the experimental group enjoyed the project-based learning activity and thought it helpful because of the digital storytelling aspect” (Chun-Ming et al. 2012).

Getting students initially engaged in a lesson is only a small part of the battle. Maintaining their attention throughout the lesson is where the real challenge lies. The resource guide will present curriculum through technological means, allowing the teacher to achieve academic success of the students as well as motivating them. Additional work was done by Siu Cheung & Yanjie (2014) in a Hong Kong primary school. Researchers studied how inquiry-based learning in a seamless learning environment could impact students. The inquiry-based learning model was presented by a teacher that received training on the implementation of such a lesson so as to correctly facilitate learning. The “seamless learning environment” was carried out by the use of the student social network Edmodo. This afforded students the opportunity to collaborate with members of their group as well as the whole class outside of school. Through this integrated learning model there were significant differences in pre- and post-domain tests, indicating advancement in students’ understanding of the concepts. Students were able to share their group products with peers, establish a positive rapport with classmates, and received teacher feedback quickly. Through this process, students developed inquiry strategies while learning to successfully work collaboratively in a new medium. The ultimate goal of the resource guide is to provide teachers with a
means to achieve increased student understanding while keeping them motivated. Utilizing a digital workspace for student communication encourages students to extend their learning beyond the classroom. When technology is paired with PBL, the optimal outcome can be achieved.

This year in my science classroom I was given the opportunity to utilize a class set of laptops. This afforded me the chance to implement many of the strategies supported by the resource guide. The students in my classroom actively participate in the use of Edmodo. Through this learning environment they are able to communicate inside and outside of class. Because of this new availability of computers, a new model for classwork was adopted. The students are given an assignment sheet from which they can choose their classwork assignments. This autonomy motivates students to complete more assignments as well as assignments that rely more on critical thinking. Students are collaboratively working on Google Slides to demonstrate their understanding in a presentation. They are participating in web-based research projects on content. I have discovered how powerful freedom of choice is. I have never had students that are more motivated to do classwork. The research from this literature review has been priceless in guiding me in the development of my technology-enhanced PBL classroom as well as the resource guide website that I have created for the teaching community.
CHAPTER THREE: METHODOLOGY

Tech PBL for All

About the Project

The decision to create this resource guide stems from my current teaching environment. I work at a private school that focuses a lot on rote memorization and utilizing worksheets to display understanding of content. Through my current STEM Master’s program I have been introduced to project-based learning. I immediately knew that this was a teaching model that needs to be implemented into every classroom. I wanted to bring into my classroom as well. I have noticed, in my twelve years of working in education, that students are not very familiar with working collaboratively and have very little experience with using critical thinking skills. I realized that this needs to change. Through research and implementation in my own classroom, I discovered that with project-based learning students learn to build these 21st century skills and become better equipped for their future in STEM-related industries. The fact that I teach science gave me the opportunity to implement PBL into a STEM classroom and simultaneously build a website that provided support for teachers who want to do the same.

Tech PBL for All (www.techpblforall.weebly.com) is dedicated to the most difficult part of creating a PBL-structured classroom, figuring out where to start. Many teachers are hesitant because they do not know where to go for resources and information on how to get started. This website provides an
introduction to PBL as well as resources for how to expand its use in the classroom.

The other goal of Tech PBL for All is to provide teachers with the tools they need to begin implementing technology into the classroom. The amount of technology that students are exposed to was the catalyst for integrating technology into PBL. I was lucky enough to get a class set of laptops this year, so I have been able to implement technology-integrated PBL into my classroom. Students are not only using the technology to gain information, read articles, and participate in simulations, but they are producing information as well. With access to technology in the classroom, students can become producers of information instead of just consumers. With technology, students can create Google Slide presentations to display their understanding. They can create Kahoot! games using the content. With the website I have created, teachers can find fun an innovative ways to incorporate technology into their PBL-rich classroom.

Resource Guide Overview

Home Page

The home page of Tech PBL for All is designed to have everything necessary for teachers who want to implement a more technology-integrated PBL teaching model into their class. On this page you have easy access to PBL and technology resources, as well as sample lessons to get even the novice teacher started. There are a variety of tabs that connect you to different parts of the site, depending on what you are looking for. A site map is also available in the upper
left-hand corner, designated by three blue lines. This will quickly show you all of
the pages on the website. The home page is laid out very simply with some
pictures from my own technology-integrated PBL classroom.

This home page gives teachers access to what Brooks and Brooks (1999)
said is so important for today’s students, a constructivist classroom that is a
combination of *what* students learn and *how* they learn. This page leads educators
on a path where they can blend these two important aspects of information
acquisition for students. Many of today’s educators are simply not familiarized
with how to do this, and this home page provides the jumping off point that they
need.

**About STEM**

When clicking on the button that takes you to the “About STEM” page,
you will find that STEM stands for Science, Technology, Engineering, and
Mathematics. Below that is a quote from President Obama. I chose this quote
because it is very powerful and really drives home the importance of an
educational system that is more focused on STEM. The page continues to
describe the importance the U.S. Department of Education puts on STEM
education. As mentioned in the introduction, our country is falling farther and
farther behind the countries that are leading the world’s economy. The graph
plainly states that the projected increase in STEM-related jobs calls for more
emphasis on STEM education.
In support of advanced STEM education, the Next Generation Science Standards have been developed. A short video describes the need and framework of the NGSS. These standards are in line with the Common Core State Standards and are requiring that teachers provide more engineering opportunities for students. Although that task sounds very daunting, many of the NGSS have engineering practices woven right into them. This page gives educators a little insight into how important STEM education is and the steps that need to be, and are beginning to be taken in order to prepare our students for success in a global economy.

**Getting Started**

The “Getting Started” page is just that, a place where teachers that are inexperienced in STEM, PBL, and technology can go to get some lesson ideas. The intention of this page is to address the need for a technology-integrated PBL structure in classrooms. The research done by Sun et al. (2012) that student understanding is directly related to the pedagogical beliefs of the teacher. It is very easy to stick with something comfortable and not step out of the box when it comes to teaching methods. However, for the benefit of our students, teachers need to be willing to change their pedagogy in order to better reach our students’ needs. This page is designed to pull teachers out of their comfort zone, but give them the tools they need. This page leads teachers that are inexperienced in this new pedagogy, through lessons that build in intensity.
One-Day Activity

This button will take teachers to a very simple lesson that is great for those who are just getting started with PBL. The actual lesson is one from the NASA Design Squad. There are a variety of other lessons that go along with this one so teachers can try others as well. I chose this lesson because it is very simple to execute with very little previous experience. The steps for preparation and the actual lesson are easy to follow. This activity is very engaging for students. As mentioned in the literature review, studies have shown that lessons that are student-centered and focus on inquiry give students a better conceptual understanding of content. The hardest part for many teachers that are new to PBL is to back off and let the students fully immerse themselves in their own learning. Sun et al. (2014) was clear that a teacher is more valuable in clarifying misconceptions and presenting students with opportunities to think more deeply about concepts through challenging questions than they are when focusing on correctness and procedure.

This PBL lesson, along with many others, did not contain any technology elements. For this reason I recommended a few technology resources that could be integrated into the lesson. A teacher could engage students by having them explore the terrain of the Moon by using Google Moon. This is only one resource that students could use for information about the Moon. NASA has many pictures and videos that could be engaging as well. The research by Shapley et al. (2011) found that technology was a huge factor in the level of engagement among students. These “Digital Natives” require more technology to keep them...
interested in activities than we are providing for them. The other two resources that were recommended are intended to get students involved in producing information. The use of Google Slides is a wonderful way to have students present information. Stupeflix is an innovative way for students to make a short movie using pictures. This requires them to collaborate with peers and involves them in the production of content.

These few technology resources are intended to give novice teachers a taste of how to incorporate technology into any kind of lesson. The previous literature review addressed an article by Foley and Reveles (2014) in regards to student success with technology integration. Without teachers that are able to adapt their lessons to incorporate technology students will not have success with technology. It is understandable that teachers that are not familiar with technology will have a harder time adapting their pedagogy, but everyone has to start somewhere. By using easy programs like those found on this page, even the most technologically inexperienced teacher can slowly begin integrating some technology into the classroom.

**Week-Long Lesson**

The week-long lesson is very much like the one-day activity, only involving more lessons. It will very likely be longer than a week if all of the activities are done. However, the lessons cold be modified to fit any teacher’s time limitations. These lessons come from NASA’s BEST (Beginning Engineering, Science, and Technology). In these lessons you really being to see
the incorporation of engineering. For this reason I provided a link to NASA’s Engineering Design Process videos. These short clips introduce students to the design process and clarify what happens at each step.

Many online NASA resources can be used for the NASA’s BEST lessons. These lessons incorporate all elements of STEM. Technology is woven into these lessons, but the resources recommended for the one day activity can be very valuable for these lessons as well. The use of Google Sheets to share information would be a great way to integrate technology into these lessons. Displaying acquired information through Google Slides would be a wonderful tool as well.

**PBL Unit**

The PBL unit provided for this website was chosen for its contrast to technology. The unit is creating a schoolyard habitat. It takes students out into nature and gets them involved in making a difference not only at their school but on a global scale as well. This unit is one that takes planning and dedication on the part of teachers, but if they have familiarized themselves with the one-day activity and week-long lessons they can be ready to tackle this unit. Again, this unit was chosen because of its contrast with the use of technology. Although students will be outside creating this wonderful new habitat at their school, they can use technology in the classroom throughout the entire process.

The beginning or planning stages can be completed using the recommended website. This online garden planner is a wonderful tool that students can use for the “planning” stage of the design process. They can create
digital blueprints of their garden and share their ideas with their group members.
As the schoolyard habitat develops, students can use Google Sheets to record data
about their habitats growth. This will allow for students to continually add
information and share it with their classmates. Another resource that was
recommended is Prezi. Prezi is an online program that lets students share
information in a new and innovative way. It is kind of like PowerPoint on
steroids. No more of those boring slide transitions. Prezi takes the viewer through
a journey. This website could be used as a final presentation of the unit project.
Utilizing these technology tools brings the natural and digital worlds together in
perfect harmony.

**PBL and Technology Resources**

These two pages are dedicated to the teachers who are ready to start
discovering and creating their own technology-integrated PBL classroom. After
implementing the one-day, week-long, and unit lessons these pages will provide
educators with a wide variety of resources they can use in their classroom. After
utilizing the other aspects of the website, teachers will realize that there is a
limited amount of PBL lessons that already incorporate technology. At this point,
because PBL is still not very widespread, the idea of technology-integrated PBL
is not readily available. Because of this, teachers will have to be creative and find
innovative ways to merge the two.

Based on the research in the literature review, it is greatly beneficial for
students to work in collaborative PBL activities that integrate technology. The
Chun-Ming et al. (2012) study found this success when utilizing digital storytelling as a way to synthesize science content. And Siu Cheung & Yanjie (2014) realized how successful it was when students were given a digital medium on which to communicate and collaborate with their peers and teacher. One of the magic-like qualities of educators is their ability to design innovative lessons that address their students’ needs. With these resources at their fingertips, teachers will have the ability to create any kind of technology-integrated PBL that they want. The possibilities are endless.

**About Me**

The about me page introduces visitors to who I am. A list of my education is found at the bottom, and as you can see, my most current accomplishment is my Master’s in Curriculum and Instruction and the STEM Leadership Certificate. These two things are what have led me to create this website in the first place, along with my love for STEM education. My background in teaching science has given me the opportunity to share my love for science. But it has also given me the opportunity to implement the technology-integrated PBL model that I am promoting with my website. Through the CSUN/Endeavor STEM Master’s program I was introduced to PBL. This one thing has completely changed the course of my teaching career. I now understand not only the need for PBL in the classroom, but for teachers to be educated about how to implement it.

Before this program I was simply teaching the way I knew how. Now, I have moved out of my comfort zone and am willing to try new and innovative
ways to educate our students. Through this experience I have learned the importance of continuing your education as a teacher. It is imperative that educators continue to learn new teaching techniques and more efficient ways to get content to our students. I believe that my experience with this program, and the success I have had in my science class has made it possible for me to bring what I have learned to other teachers through my website, Tech PBL for All.

**Blog**

The blog on this website is intended as a platform for the sharing of ideas. Often teachers find that their school is lacking a Professional Learning Community (PLC). This blog will give teachers a home away from home where they can share ideas and look for advice. Support from teachers that are trying to make the same changes as they are is paramount in growing as a PBL teacher. On this page teachers can share resources, give feedback on technology tools, and share lessons that worked well for them. I look forward to the growth of this page and the amount of information that will be shared once teachers begin using it.
CHAPTER FOUR: TECH PBL FOR ALL RESOURCE GUIDE

The home page presents a variety of paths to finding what an educator needs when visiting the site. On this page visitors can be connected to information about STEM, receive help with getting started, as well as PBL and technology resources.

At the bottom of the home page there are buttons to take you to the blog as well as a page about my history and journey as a STEM teacher. At the very bottom there are links to ISTE (International Society for Technology in Education) and New Tech Network where you can find up to date news about technology and PBL. In addition, there is a home menu in the upper left-hand corner, designated by three teal lines that will allow you to jump to any of the main pages on the website.
The first place that visitors are guided to is the “About STEM” tab. By clicking here you are led to a page that familiarizes you with STEM. A graph that shows the increase in STEM-related jobs shows the importance of STEM education. Further explanation about STEM from the U.S. Department of Education then leads into information about the Next Generation Science Standards (NGSS). There is also a brief informational video about the NGSS that is helpful.

From the home page visitors can click on the “Getting Started” tab to find recommended technology-integrated lessons for teachers at any state of implementing PBL. For beginners, a simple one-day activity is available. As teachers become more familiar with PBL they can choose from a week-long lesson or a full PBL unit.
The one day technology-integrated PBL activity is a simple lesson chosen from the NASA Design Squad activities. This activity requires very little preparation and has a very simple teacher’s guide. I have suggested a few ways in which to integrate technology. This lesson does not involve any technology aspects; however, there are many simple ways to get students using technology. Recommendations for implementation are available in captions below the links.

The week-long technology-integrated PBL lesson is one from NASA’s BEST. The image of the Engineering Design Process contains a link to NASA’s informational videos. This is a great way to start introducing students to engineering. The educator’s guide is for grades 3-5 and leads the teacher through a variety of STEM lessons.
The technology-integrated PBL unit is great for those teachers who have had the opportunity to implement some PBL into their curriculum and want to take it to the next level. This unit guides students through creating a schoolyard habitat. This is a wonderful opportunity for students to begin making an environmental impact while beautifying their school and learning science. Some tools for integrating technology are a garden design website and the use of Prezi to prepare a presentation of the design.

Once teachers are comfortable with implementing the suggested PBL lessons, they can go to the “PBL Resources” page to read a little more about the place PBL has in every subject. Despite the connection between PBL and STEM, a student-centered, inquiry-based approach can be used in any subject. Here teachers can find some wonderful links to websites that provide a variety of PBL lessons and units for any subject.
The other important aspect of this website is the “Technology Resources” page. This page encourages teachers to take the plunge into the technology world with which their students are so familiar. The links lead teachers to wonderful tools that students can use to receive information, but also ones that allow them to begin creating information.

The “About Me” page gives a background on my teaching experience and my connections to STEM education. With the time that I have spent teaching science as well as learning more about teaching STEM, I have become well equipped with knowledge and resources that I am excited to share with my fellow educators.
The “Blog” page is intended to be a place where educators can share their experiences with PBL and technology. It is also a message board for questions, answers, and recommendations for those looking to restructure their classrooms into ones that incorporate PBL and technology. This is where teachers can share some wonderful resources as well.
CHAPTER FIVE: IMPLICATIONS

This project is intended to make resources readily available to educators. Many teachers would like to begin implementing technology-integrated PBL but simply do not have the training and opportunities. Teachers with different skill sets need a resource such as this as it provides an easy-to-access source of teacher-friendly instructions, examples, and support. From beginners to veterans, this website advances technology-integrated PBL for K-8 classrooms.

This resource guide addresses a number of problems within the teaching community. Educators need to be informed on how computer-supported, collaborative STEM-learning formats affect student engagement and motivation-to-achieve. Tech PBL for All provides teachers with research-based information as well as sample lessons to aid them in beginning their journey towards this kind of teaching model. These lessons prepare teachers for being able to design and lead their own hands-on, minds-on integrated-STEM activities that allow for students’ deeper understanding of the content while motivating them to pursue inquiry across the curriculum. Lastly, the PBL and technology resources provided on the website will enable educators to utilize PBL principles while integrating technology to effectively enhance students’ attainment of Common Core’s 21st century skills.

One of the main reasons why more teachers do not use a technology-integrated PBL teaching model is that they do not know where or how to begin. Tech PBL for All places resources at teachers’ fingertips. It supports those
teachers who are not yet familiar with PBL with sample lessons they can implement immediately. Once teachers are familiar with PBL and how to incorporate some technology, or if they are already familiar, they can utilize the PBL and technology resource to begin designing their own technology-integrated PBL lessons. The blog creates a digital professional learning community where lesson can be shared, along with questions, ideas, and research. Many schools are lacking a collaborative community of teachers that can support and enhance each other’s growth as professionals. The blog allows for this to happen with teachers all around the world.

Although this website is a major step toward preparing educators for the necessary changes in the classroom that will be associated with the NGSS, more research still needs to be done. The majority of research on project-based learning is done outside the United States. Asian countries produce the bulk of research on this topic. More studies need to be done stateside to ensure that our students are being better represented in the research. Although any research is helpful, there is an inherent need for research among our own U. S. schools.

More emphasis is also needed on research done with elementary students and PBL. Much of the research done is in college and secondary grades. While this is important research, the place where PBL needs to be implemented the most is in elementary schools. Students need to be exposed to PBL as early as kindergarten. The lack of research suggests that there is not much PBL taking place in these lower-grade levels. Hopefully, with websites like Tech PBL for All and the implementation of the NGSS and Common Core State Standards, more
teachers will begin using the technology-integrated PBL teaching model. Then, more research can be done in our nation’s schools.

My hope is that, with the availability and use of this website, teachers will feel more empowered to design a more student-centered classroom that engages students through the use of technology and project-based learning. Often teachers just do not know what is out there. This resource guide gives responds to this need with lessons that are simple to implement and resources that are literally at educator’s fingertips.
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