Fall 9-13-2015

Units of Study: A Curriculum Supplemented with Problem-Based Learning and Technology

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UNITS OF STUDY:

CURRICULUM SUPPLEMENTED WITH PROBLEM-BASED LEARNING AND TECHNOLOGY

by
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A capstone submitted in partial fulfillment of the
requirements for the degree of Master of Arts in Teaching

Hamline University

Saint Paul, Minnesota

August, 2015

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Chapter One

Introduction

The research question I will investigate is as follows: How can I provide 5th grade students with opportunities to engage in reading, writing, and talking about texts and ideas across different instructional contexts using technology and problem-based learning? This introduction contains three sections. The first section explains how I arrived at my research question. It includes a brief overview of the curriculum in place in my district as well as my approach to implementing this curriculum. The second section spells out my reasons for embarking on this particular research journey. Finally, the third section serves as a conclusion and summary of this chapter and also includes a preview of chapter two.

The Story Behind the Question

After teaching first, second and fifth grades for ten years in a school district that, until last year required all teachers to be teaching the same lesson on the same "day" in their basal reader, the transition to a new district with a much different curricular philosophy was quite a shock. I stepped into a situation that was about as far from a basal-based program as could be, and, boy was I excited. The prospect of teaching with authentic literature, both fiction and nonfiction, and using mentor texts to guide my instruction was a breath of fresh air. The freeing and somewhat ambiguous curriculum I am referring to is called The Units of Study.

The Units of Study Curriculum. The Units of Study is based on the literacy research of Fountas and Pinnell (2011) and focuses primarily on two books written by

these researchers: *The Continuum of Teaching and Learning PreK-8* and *Genre Study*. The guiding principles of the Units of Study are as follows: students learn by talking; students need to process a large amount of written language; students expand their ability to read and comprehend texts through talking and writing; and students' learning deepens when they engage in reading, talking, and writing about texts across many different instructional contexts (Pinnell and Fountas, 2011). According to Fountas and Pinnell (2011) these principles are supported through the use of various forms of reading, writing and oral communication.

My approach to implementing the curriculum. As I developed probing, high-level questions to ask during interactive read aloud and orchestrated the conversations I knew we were sure to have, I congratulated myself on what a forward thinking, student-centered teacher I was becoming. Students responded to their independent reading (their choice, of course) through letters to me, genre projects that tapped into their desire for creativity and sharing with their classmates. I selected what I thought to be high interest engaging texts just a little beyond students' levels to read during Guided Reading so as to increase their comprehension levels. We used mentor texts to learn about what good writers do and wrote traditional literature, short fiction, memoirs and informational text incorporating the strategies that all the really great authors use. This is where I lost it. The students in my classroom had no reason to engage in a deeper level of learning. If what Fountas and Pinnell stated was true and deeper learning only occurs when students have the opportunity to share their learning through various contexts (2011) then I was not

providing my students with the opportunity for deeper learning. They shared their learning with me and maybe a couple of their peers during sharing, but that was it.

Technology? Technology was an obvious solution to my problem, but with only a couple of computer carts to share among the whole school, limited knowledge on the types of technology most well suited to the classroom, and an even more limited amount of time to try to figure it all out I was overwhelmed. I integrated technology as a research tool. We used it to word process, and I dabbled in using my school's Google Drive system as a way to collaborate with students and offer feedback on their assignments. I used Google Classroom to assign work and Google Forms as an alternative to paper math tests. I am not diminishing the progress I made in integrating technology into my classroom, but I knew what I was doing was not adding to the curriculum in a meaningful way.

Although, my attempts at technology integration were useful, they didn't give students a new way to process and share their ideas, which is the goal of our curriculum. They were processing the information in the exact same way they always had been. It was just the delivery system that was different. I needed to offer my students a more challenging and meaningful reason to process their ideas differently. I needed to offer them an opportunity to apply the ideas they were reading, writing, and talking about in our classroom in a way that made sense to them but also demonstrated to me that they were learning.

Destination Imagination. What I really wanted for my students was authentic, real-world reasons to read, write, and have conversations. I knew this was possible

because of a few unique groups of students who took part in a special extracurricular program offered at my school called Destination Imagination (DI). Destination Imagination is a creative, problem-solving program for students, kindergarten through college. Team members solve one of six challenges and then present their solution to a panel of judges. This year I have a group of students who have worked together on the same DI team since third grade. Their solutions have won first prize every year they have participated. The team meets three mornings a week before school, and the excitement in their voices each morning as they came into the classroom after a DI meeting was unmistakable. One of the students on this team is what his case manager refers to as "twice exceptional" meaning he is autistic but also gifted and talented. This student refuses to do most work in the classroom but has been a contributing member of a first prize winning DI team for three years. When I asked him why he was so willing to put in the work for his DI team he told me "because it is a real problem and somebody will really use what we do.". If this type of real-life learning could get this student reading, writing and communicating I knew I would have no problem convincing my other students to get on board. I found that there was a name for this type of learning: problem-based learning (PBL). I started exploring different types of PBL as a possible solution to the gap in our curriculum. It turns out I found in problem-based learning exactly what I had been looking for.

Problem-Based Learning. According to the Buck Institute for Education (BIE) problem-based learning is a teaching method in which students spend a significant amount of time investigating and responding to a complex question, problem, or

challenge. It is through this investigative, inquiry based process that students gain the skills and knowledge necessary to meet grade-level standards. In addition to a focus on significant content, PBL is learner centered. Students' work is based on questions they understand and are interested in with an end goal of presenting their findings to a public audience beyond their teachers and classmates (BIE). As I began to delve deeper into the this idea of problem-based learning I was introduced to Challenge Based Learning which is a flexible model for integrating PBL into the classroom.

Challenge Based Learning (CBL). CBL encourages students to use the technology available to them in their everyday lives to solve real-life problems. A key component of Challenge Based Learning is that students document each step of their experience. This documentation can be in the form of blogs, videos, or any other tools that will allow them to later share their solution with the world. This focus on sharing thoughts and learning in a variety of ways fills the gap I identified in my curriculum. Additionally, CBL involves collaboration not only between teachers, students, and peers, but also between students and people who are experts in the problem area in which the students are focusing. This type of collaboration also requires students to communicate their learning and thoughts in a whole new way further supporting my goal of creating an experience for students to deepen their learning through the ability to communicate in a variety of ways.

Research Purpose

After struggling through this year, attempting to make learning more meaningful and purposeful for my students through a half-hearted effort to integrate technology and contrived attempts at real-world problem/solution opportunities, I want to go into next

year with this missing portion of our curriculum in place. I will continue to teach students the strategies and skills necessary for increased comprehension but with the addition of a real-life, problem-based component that utilizes technology in a meaningful way. I hope to give students the opportunity to process what they have learned in different ways, which will lead to deeper comprehension.

Additionally, within the next couple of years my school district will be moving to a 1:1 student to tablet ratio. It is an expectation within our district that teachers move toward adopting the Technological, Pedagogical, Content Knowledge (TPACK) framework which will require teachers to continue to not only teach effectively, but to teach effectively with technology. According to Koehler, Mishra, and Cain (2013), TPACK is the teacher's ability to combine content and pedagogical knowledge with technological knowledge. Technological knowledge can be defined as the ability of a person to understand technology enough to use it productively, to recognize when it can be useful and when it might not be, and to adapt to changes in technology. In order to effectively teach our current curriculum and the state standards we need to guide students in learning to read, talk and write within a variety of contexts. With the appropriate use of technology, the variety of contexts available for students to communicate within becomes much broader. By putting this curriculum supplement in place now I will be providing a starting point for colleagues who are only just beginning to think about how to accomplish this task.

Finally, with America's Next Best Workforce legislation and the 21st century learning skills that are said to be of the utmost importance in educating our children for

the future, the competencies students will gain through Challenge Based Learning will be invaluable. According to the Partnership for 21st Century Skills, in addition to traditional content knowledge such as science, math, and language arts, students must also learn critical thinking, problem solving, and communication and collaboration. Through Challenge Based Learning, students will be required to demonstrate these skills.

Conclusion

I began this chapter by stating my research question: How can I provide 5th grade students with opportunities to engage in reading, writing, and talking about texts and ideas across different instructional contexts using technology and problem-based learning? In an attempt to answer this question, during this study, I will integrate Challenge Based Learning and all of its components into one of the seven Units of Study that comprise my district's curriculum. This chapter introduced the curriculum I have to work within as well as the efforts I have already made to integrate technology and problem-based learning into my classroom. I also described the three main reasons why I feel this is a necessary question to answer.

In chapter two I present the professional literature that connects to and supports my research topic. I discuss problem-based learning and the key elements that define it as well as why it is a viable educational model, how it can be implemented, the teacher's role, and challenges associated with this method. Finally, I review the literature on technology integration in the classroom to include information on the Technological, Pedagogical and Content Knowledge (TPACK) framework as well as information on supporting 21st century skills with Web 2.0 tools.

Chapter Two

Literature Review

Overview

The purpose of this literature review is to answer the following question: How can I provide 5th grade students with opportunities to engage in reading, writing, and talking about texts and ideas across different instructional contexts using technology and problem-based learning? The review will begin with a discussion on the research surrounding 21st century skills. I will explain what they are, why they matter and how they can be best implemented in today's classrooms. The inclusion of 21st century skills in this review was important because it is through these different skills that my students will be able to demonstrate their knowledge.

I will then move into a review of the literature on problem-based learning which will include a synthesis on why problem-based learning is a viable option for meeting student needs, the key elements of problem-based learning, how to best implement problem-based learning, the teacher's role in problem-based learning and the challenges in adopting problem-based learning. Problem-based learning is the framework I will use to deepen my students' knowledge of the texts and ideas they are learning about in the Units of Study curriculum.

Finally, I will end the chapter by reviewing technology integration in the classroom. I will focus on describing the technology pedagogy content knowledge framework (TPACK) as well as digital learning and Web 2.0 tools. I have included this

section on technology integration because the use of technology will also provide my students with an opportunity to engage in texts and texts and ideas in many ways.

21st Century Skills

What are they? Although there are a variety of frameworks that aim to define what qualifies as a 21st century skill, the Partnership for 21st Century Skills has published a framework that is more detailed and widely adopted than any of the other alternatives (Dede, 2010 & p21.org). The Partnership divides 21st century skills into five categories: core subjects, 21st century content/themes, learning and thinking skills, information and communications technology literacy, and life skills (Dede, 2010 & p21.org). I will briefly describe each of these categories below.

The core subjects are identified as English, reading, or language arts; mathematics; science; foreign languages; civics; government; economics; arts; history; and geography (Dede, 2010; p21.org). It was The No Child Left Behind Act of 2001 that identified these as the core subjects although they were first named as core subjects by the Elementary and Secondary Education Act of 1965 (Dede, 2010). These core subjects that make up the curriculum in typical American schools are only the tip of the 21st century skills iceberg.

In addition to basic competency in the core subjects listed above, the Partnership believes that schools must promote understanding of academic content at much higher levels by integrating 21st century interdisciplinary theme**s** into core subjects (Framework for 21st Century Learning). These 21st century content themes include global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; and health and

wellness awareness (Dede, 2010 & p21.org). These themes should be woven throughout the core subjects but are not often a focus in schools although they are critical to success in communities and workplaces (Dede, 2010; p. 21.org).

Learning and thinking skills are another component in the 21st century skills framework. These are identified by the Partnership as being those skills that allow students to keep learning and making effective and innovative use of what they know throughout their lives (Framework for 21st Century Learning, n.d.). Learning and thinking skills encompass critical-thinking and problem-solving skills, communication skills, creativity and innovation skills, collaboration skills, contextual learning skills, and information and media literacy skills (Dede, 2010; p21.org).

Information and media literacy skills have become such an integral part of students' lives it is necessary to expand on these skills as well as other forms of communications literacy in a separate category called information and communications technology. Information and communications technology is defined as the ability to use technology to develop 21st century content knowledge and skills within the context of the core subjects listed above (Dede, 2010; p21.org). The premise of this category is that technology should serve as a tool for students to learn the content and skills they will need in order to engage in lifelong learning, the productive use of information, critical thinking, problem solving, communication, innovation and collaboration (Dede, 2010; p21.org).

Finally, the Partnership calls for schools to incorporate certain life skills that students will use in all areas of their professional and personal lives. The Partnership is adamant that these skills are not only incorporated into curriculums but are incorporated deliberately, strategically, and broadly throughout the curriculum (Dede, 2010; p21.org). According to the Framework for 21st Century Learning, these skills include leadership, ethics, accountability, adaptability, personal productivity, personal responsibility, people skills, self-direction, and social responsibility (Dede, 2010; p21.org).

Why they matter. The overarching theme in the research and literature supporting the need for 21st century skills is that the United States is not preparing young people with the skills they need to compete in a global economy (Partnership for 21st Century Skills, 2007). Carnevale and Desrochers (2002) wrote that, as our nation shifts from an industrial economy to one rooted in information and knowledge, our economic competitiveness is based on our ability to produce and disseminate education. Unfortunately, many are concerned that the types of skills emphasized in education today are not producing people with the skills necessary to remain competitive in an information rich, global economy (Bellanca & Brandt, 2010 p. 1). In a nationwide poll of registered voters 80 percent of those polled felt that the kind of skills students need to learn to be successful in today's economy are different than the skills necessary twenty years ago (Partnerships for 21st Century Skills, 2007).

According to Wagner (2012), in order to equip students with the skills they will need to get and keep good jobs in the new global economy, schools must focus on teaching critical-thinking and problem-solving, effective oral and written communication,

collaboration, and initiative among other skills. Additionally, workers who can adapt and contribute to the work force and who can work flexibly to respond to organizational expectations are in demand by today's employers (Kay, 2010). These are the skills that set people apart from their competitors (Kay, 2010). These innovative skills are in high demand, yet employers report that even college educated entrants to the workface are deficient in these and other applied skills (Kay, 2010). Competency in 21st century skills gives students the ability to meet these complex needs identified by today's workplaces (Kay, 2010).

Skills that foster innovation are not the only necessity in developing productive citizens for the 21st century. The Partnership has also identified several 21st century themes, grounded in everyday life, as being crucial to the education of every student (Kay, 2010). In our current global economy students need to work collaboratively and communicate effectively with people from a range of diverse cultures and lifestyles (Kay, 2010). According to Kay (2010), people today are more responsible than ever for their own retirement planning and saving and investment management, requiring a deeper understanding of how economic forces impact people's lives. Students entering the professional world with these 21st century competencies should be able to step into a situation they have never been in before and have the ability to know what to do (Kay, 2010).

Finally, an education system that is not providing students with the skills needed to compete in a global economy isn't the only issue the United States faces. We may not be able to afford the educational changes necessary to maintain our competitiveness

among other world powers (Carnevale & Desrochers, 2002). According to Kay (2010), the United States does not even have a clear purpose or direction for securing our economic competitiveness much less a plan for funding it. A focus on 21st century skills promotes a stronger alignment between K-12 curriculum and work requirements which allows for greater efficiency in spending (Carnevale & Desrochers, 2002).

Implementation. Without a supportive infrastructure, it is unfair and unproductive to expect students to meet these new and higher expectations which include 21st century skills (Kay, 2010 p. xxvi). According to Marzano (2003), the most important school-level factor that impacts student achievement is a "guaranteed and viable curriculum". McTighe and Seif (2010) built on Marzano's claim by highlighting the importance of a coordinated curricular design that incorporates designated skills, processes, and habits (p.152). This curriculum must focus on "big ideas" in core subjects and 21st century skills, assess outcomes in appropriate ways, and map the curriculum backward (McTighe & Seif, 2010, p. 154).

Teachers today are faced with too much content and not enough time to teach it all (McTighe & Seif, 2010, p. 154). In order to combat this "mile wide, inch deep" curricular focus, educators must instead focus curriculum around a core set of big ideas and essential questions within the content they are to teach (McTighe & Seif, 2010, p. 155). These big ideas are fundamental to the core subjects, promote deeper thinking and support the transfer of learning to new, unfamiliar situations. Because of this more focused curriculum, teachers have more time to focus on teaching 21st century skills that give students the tools they need to deepen their learning in the core subjects (McTighe &

Seif, 2010, p. 156). Implementing a curriculum that supports the teaching and learning of 21st century skills also requires open-ended, performance based assessments that allow students to demonstrate their understanding of big ideas, formulate responses to essential questions, analyze important issues, solve genuine problems, conduct research, work collaboratively, and use technology, all which are essential skills in the real world (McTighe & Seif, 2010, p. 158).

Knowing what a curriculum that promotes consistent exposure to and instruction of 21st century skills should include isn't enough though. Teachers need to know how to teach to achieve the important 21st century outcomes that have been outlined so far. McTighe and Seif (2010) put together five recommendations that they believe students should experience each day if they are to achieve 21st century outcomes. In order to help learners to understand, develop, deepen and apply 21st century skills, teachers must use engaging, interactive instructional strategies such as problem-based learning or collaborative projects (McTighe & Seif, 2010, p. 165). Twenty-first century skills should also be taught and applied throughout a student's education and in all academic areas (McTighe & Seif, 2010, p. 156). McTighe and Seif (2010, p. 166) also stressed the importance of providing students with many opportunities to apply their learning in new and different relevant, real-life situations. Finally, McTighe & Seif (2010, p. 167) highlighted the value in ongoing assessment of students' level of understanding of targeted big ideas and 21st century skills as well as in establishing a classroom climate that encourages students to ask questions, discuss ideas, give feedback and share their thoughts and opinions.

Summary. The inclusion of 21st century learning skills in today's curriculum is not only supported by many educators but also businesses, communities, and parents alike. Supporters of curriculum that promotes these skills combat criticism that the time spent emphasizing critical thinking skills and problem solving will take away from the teaching of academic content in the core subject areas with a promise to address core content at a deeper level through 21st century skills (Brandt, 2010, p. ix). Through strategic teaching methods teachers can weave these skills into their curriculum without forsaking local, state, and national standards. One of the ways experts suggest this can be done is through problem-based learning.

Problem-Based Learning

As an innovative instructional method with roots in the health sciences, the adoption of problem-based learning as a teaching method has spread to elementary schools, middle schools, high schools, universities and professional schools (Savery, 2006). According to the Buck Institute for Education (BIE), problem-based learning (PBL) is a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to a complex question, problem, or challenge. Savery (2006) described PBL as "a learner-centered approach that empowers learners to conduct research, integrate theory and practice and apply knowledge and skills to develop a viable solution to a defined problem" (p. 12). Hmelo-Silver (2004) described PBL as consisting of complex problems that do not have single correct answers. Barell (2010) went so far as to suggest PBL as a rethinking of the entire curriculum so that units are designed around complex, realistic problems that embody the curricular concepts to

be learned and understood. Barell's suggestion mirrors the argument of Savery & Duffy (1995) that in PBL, the learning that occurs is a result of the process of grappling with the problem rather than a test for understanding as is the case in other case based approaches to learning. With so many instructional methods available to teachers why is problem-based learning peaking the interest of K-12 teachers around the country?

Why PBL. After a review of the research on PBL, The Center for Excellence in Leadership of Learning (2015) reported PBL as eliciting positive outcomes related to student learning in the areas of content knowledge, collaborative skills, engagement, motivation, critical thinking and problem solving skills all of which were stated above as being essential skills for 21st century learners. In a similar review of the research on PBL the Buck Institute for Education (2015) found PBL to have positive effects on academic achievement, 21st century competencies, equity, motivation and teacher satisfaction (20.

In their review of available research the BIE point to several studies that compare academic achievement in PBL to more traditional, textbook-and-lecture driven instruction. In a study done by Penual and Means (2000) it was found that students learning through PBL retain content knowledge longer and have deeper understanding of what they are learning. Several studies reviewed by BIE found that PBL is more effective than traditional methods in specific content areas such as math, economics, language, and science (Beckett & Miller, 2006; Boaler, 2002; Finkelstein et al., 2010; Greier et al., 2008; Mergendoller, Maxwell, & Bellisimo, 2006). And finally, in regard to academic achievement, it was found that PBL students perform as well or better than traditionally taught students on high-stakes testing (Parker et al., 2011).

As discussed in the previous section, 21st century skills are a must for today's students. According to the research summary compiled by BIE, problem-based learning helps students to master these key skills. BIE cited research showing that students demonstrate better problem-solving skills during PBL than in more traditional classes and are able to apply what they learn to real-life situations (Finkelstein et al., 2010). In another study cited by BIE it was found that teachers who are trained in PBL methods spend more time teaching 21st century skills and have students who perform at least as well on standardized test as students engaged in traditional instruction (Hixson, Ravitz, & Whisman, 2012). Additional research reviewed showed improved abilities to think critically, work collaboratively and resolve conflicts (Beckett & Miller, 2006; Horan, Lavaroni, & Beldon, 1996; Mergendoller, Maxwell, & Bellisimo, 2006; Tretten & Zachariou, 1995; Beckett & Miller; ChanLin, 2008). Finally, it was found that PBL increased opportunities for collaborative learning to students across grade levels, academic subjects, and achievement levels (Johnson & Johnson, 2009; Slavin, 1996).

In their review of the research BIE also found several studies that show positive effects of PBL on establishing equity among students. It was found that PBL is a promising strategy for closing the achievement gap as it engages lower-achieving students (Boaler, 2002; Penuel & Means, 2000). According to the research cited by BIE PBL can also work in different types of schools, serving diverse learnings and can even provide an effective model for whole school reform (Hixson, Ravitz, & Whisman, 2012; National Clearinghouse for Comprehensive School Reform, 2004; Newmann & Wehlage, 1995; Ravitz, 2008).

Finally, BIE reviewed the research on PBL's effect on both motivation and teacher satisfaction. It was found that in PBL classrooms, students demonstrated improved attitudes toward learning and were more engaged, self-reliant, and present than students in more traditional settings (Thomas, 2000; Walker & Leary, 2009). Additionally, teachers who made the shift to PBL reported increased job satisfaction (Hixson, Ravitz, & Whisman, 2012; Strobel & van Barneveld, 2009).

Despite all of the positive outcomes the research on PBL has produced, there is still some evidence that points to its limits. There is research to suggest that students have difficulty initiating inquiry, directing investigations, managing time, and using technology productively in a PBL based classroom (Thomas, 2000). It has also been found that teachers find PBL to be challenging to plan and enact (Thomas, 2000). And finally, although research tends to favor PBL over traditional teaching methods when it comes to motivation, problem-solving and self-directed learning, research still supports more traditional teaching methods when it comes to measures of content knowledge (Ertmer & Simons, 2006).

Despite its shortcomings, the benefits of a PBL classroom have led to a more widespread adoption of the teaching practice. As more teachers have begun to embrace and implement PBL the definition of what constitutes true project based learning has become muddied. Certain practices that are referred to as PBL may fail to achieve the desired learning outcomes of PBL (Savery, 2006). For this reason it is important to review the elements necessary for a unit to truly be considered problem-based learning. In this section I will describe the key elements to PBL unit. I will also describe the

teacher's role in a PBL unit, steps necessary for implementation of a PBL unit and the challenges those adopting PBL might face.

Key Elements and Goals. Barell (2010) suggested that the following ten key elements be included in a problem-based learning unit. These same elements, save for a few minor differences in wording, can be found in most of the research on problem-based learning. For this reason, I will reference other research on the key elements but will not go into detail on all of it.

First, problems must be real-world, foster inquiry, and embody concepts like change, equality, and environment (Barell, 2010). Savery (2006) supported this claim in saying that the process of identifying the problem and setting parameters on the development of a solution when the problem is real world and ill-structured is a critical skill in PBL. If the problem is well-structured or contrived students are not as motivated in the development of a solution.

Students must also be given choice about content and ways to learn and share their understanding of the research (Barell, 2010). Similarly, Barell stated that teachers and students must share control of decision making, teaching and learning. According to Hmelo-Silver (2004), PBL aims to help students become intrinsically motivated. When students are able to work on a task based on their own interest they become more intrinsically motivated to tackle a challenge (Hmelo-Silver, 2004). Companies such as Google have seen many of their most important innovations born from corporate policies giving all employees an equivalent of one day a week to work on any project they choose

(Wagner, 2012). Students too would benefit from time to pursue their own interests (Wagner, 2012).

Barell (2010) stated the importance of objectives that require students to pose questions, conduct purposeful research, think critically, make decisions, and draw reasonable conclusions supported with evidence. Wagner (2012) attributed these skills to developing creative problem solvers who will use academic content to pose and solve problems and answer complex questions.

The ability to collaborate within a small-group using skills such as listening, reasoning together, and building upon each other's ideas is another key element to a successful PBL program according to Barell (2010). Hmelo-Silver added that a good collaborator can also establish common ground, resolve discrepancies, negotiate the actions the group is going to take and help the group come to an agreement (Hmelo-Silver, 2004). Furthermore, the ability to explain one's ideas is not only necessary for productive collaboration but also serves to enhance learning (Hmelo-Silver, 2004).

Feedback from classmates and teachers on the student's final findings is necessary and should reflect types of feedback that occur in actual life experiences (Barell, 2010). For example, realistic feedback might begin with "What we liked…" or "A question I have is..." (Barell, 2010). This type of feedback is important because it encourages the learner to reflect on the experience and requires the learner to examine all of the work that was done to better understand what they know, what they learned and how they performed (Savery, 2006).

Students must also be given the opportunity to revise, modify and elaborate on their findings (Barell, 2010). In order to be successful in this area student must have a metacognitive awareness of what they do and do not understand (Hmelo-Silver, 2004). Students must also be able to recognize what they need to learn more about in order to complete the task at hand as well as how they are going to go about learning the necessary information (Hmelo-Silver, 2004).

Another key element of a PBL unit is student participation in the planning of, monitoring of, and self-reflection on work, progress, and results (Barell, 2010). Students must have responsibility for their own learning (Savery, 2010). According to Savery (2010), when the responsibility for developing a solution to a problem as well as the steps to the solution lies with the learner motivation increases. PBL is a learner-centered approach that requires students to engage with the problem no matter what their current knowledge or experience.

A PBL unit must also include opportunities for the teacher to obtain pre-, formative and summative assessment information (Barell, 2010). Since the goals of PBL are both knowledge-based and process-based students need to be assessed on both at regular intervals to ensure the meeting the necessary objectives (Savery, 2006). Included in this element is the expectation that the student will be able to recognize and articulate what they know as students are responsible for the content in the curriculum that they have covered through engagement with problems (Savery, 2006).

In order to address teacher concerns regarding preparation and planning for a PBL unit Barell (2010) suggested a step by step process for developing a clear curricular

structure centered on authentic problems and inquiry which is the final element in a PBL unit. According to Barell (2010) teachers should first identify a topic and then map out the concept. Once the teacher has identified relevant concepts, state and local standards should be consulted to determine which concepts must be included. Once necessary concepts are identified, intended outcomes and essential questions should be specified. Barell (2010) then suggested creating a problematic scenario that will spark students' interests and provide a structure for the unit. At this point strategies for generating questions and observing student learning should be developed (Barell, 2010). Savery and Duffy (1995) laid out a similar approach geared towards higher education. This approach also includes the generation of learning goals and a problem, but for the purpose of this paper I will not go into more details.

Implementation. In general, the outlines of most PBL units follow the same general pattern with some models adding their own twists. For the purposes of this paper I will provide descriptions of the steps common to all PBL models.

The implementation of a problem-based learning unit begins with students being divided in groups (Savery & Duffy, 1995). In some PBL models groups are prearranged by the instructor and in other models students self-select groups based on interest.

The next step, which is common of all PBL units, is the presentation of the problem (Savery & Duffy, 1995). In K-12 education this problem is generally presented as a problematic scenario (Barell, 2010). According to Barell, this scenario, designed by the teacher, "embodies the essential elements of the unit so that as students inquire and discern, they encounter the ideas and concepts the teacher wants them to think deeply

about; this process introduces the core content of the scenario." As stated in the previous section, the problem presented is delineated from the identified learning objectives (Savery & Duffy, 1995).

Once the problem is presented students begin the inquiry process. Within their groups students must discuss what they think they know about the problem and use their metacognitive skills to determine what they will need to know in order to create a solution to the problem (Barell, 2010). Students might also form a hypothesis regarding the solution based on their prior knowledge (Savery & Duffy 1995). The amount of facilitator involvement at this point varies greatly depending on the age and experience of the students. For students in a K-12 setting students may need more guidance in organizing and analyzing their learning issues (Barell, 2010).

After students determine what they need to know students engage in self-directed learning (Savery & Duffy, 1995). It is at this point that students work individually or in teams to conduct research that will either be presented to their team at the next meeting or presented to the class in the form of a lesson (Savery & Duffy, 2006 & Barell, 2010). This is another step in the implementation process that will require varied guidance from the facilitator depending upon the experiences of the students. More inexperienced students will need assistance in determining how they should go about finding answers and how they should manage their class time (Barell, 2010).

After this period of self-directed learning students come back together to share what they have been learning (Barell, 2010). This is an opportunity for students to re-examine the problem and reflect upon their new learning (Savery & Duffy, 1995). As

students re-examine the problem in light of new learning new issues may arise and students might find they need to engage in more self-directed learning (Savery & Duffy, 1995). This cycle continues until students have found a viable solution to their problem and are ready to present what they have learned (Barell, 2010). Facilitators can keep this process on track by asking questions such as (1) what part of the process are you working on this week?, (2) What has been your biggest success/challenge this week?, (3) How is your group doing as a team?, and/or (4) What are your priorities for next time? (Challenge Based Learning, A Classroom Guide, 2012).

Once students are prepared to present their final learning, facilitators must be prepared to offer direct feedback (Barell, 2010). This feedback serves as a springboard for students to make needed adjustments and improvements before the final presentation or implementation of their plan and/or solution (Barell, 2010 & Challenge Based Learning: A Classroom Guide, 2011). To guide feedback facilitators might consider creating a rubric with the students during planning (Barell, 2010 & Challenge Based Learning; A Classroom Guide, 2011).

It is at this point that students should make the final adjustments to their presentations and prepare to share them with an authentic audience (Challenge Based Learning: A Classroom Guide, 2011). The ability for students to apply the results of their investigations to their daily lives is essential to the authentic nature of a PBL unit (Barrell, 2010). After students have had the opportunity to share their final presentations students must reflect on what they learned about the content, process and overall experience (Challenge Based Learning: A Classroom Guide, 2011). This reflection

should also draw out any new questions students have after completing the investigation as well as thoughts on how students might pursue these new questions in units to come (Barell, 2010).

The Teacher's Role. In PBL the teacher's role is to facilitate the construction of knowledge (Hmelo-Silver & Barrows, 2006). According to Hmelo-Silver and Barrows (2006), the teacher guides the students in their learning while modeling questioning strategies that will benefit students in their own inquiry. Savery & Duffy (1995) go on to explain that the higher order thinking that is modeled through questioning is designed to probe students to think more deeply and the facilitator should avoid using his or her knowledge of the content to ask questions that might lead the learners to what they feel is the "correct" answer. Instead facilitators must guide students to key pieces of knowledge through questions that scaffold student learning (Hmelo-Silver, 2006). According to Hmelo-Silver (2006), facilitators must also model good strategies for learning and thinking rather than provide specific content knowledge.

Schmidt & Moust (2000) found three factors that contributed to effective facilitation. First, facilitators must have an appropriate knowledge base regarding the topic being studied (Schmidt & Moust, 2000). Effective facilitators must also exhibit a willingness to become involved with students in an authentic way and must possess the ability to express themselves in a way students understand (Schmidt & Moust, 2000). Savery & Duffy (1995) also point out the importance of a facilitator's ability to help students develop self-directed learning skills such as strategies for identifying learning issues and locating, evaluating and learning from resources relevant to the issue (Savery

& Duffy, 1995). Additionally, Hmelo-Silver & Barrows, (2006) wrote about findings from Koschmann's 1999 Discourse Processes in which researchers observed the facilitator engaging in several behaviors to scaffold the group's ability to see a solution to the problem they were working on (Hmelo-Silver, 2006). Throughout this observation the facilitator engaged in a variety of strategies to (1) keep the process going with all students involved, (2) help students' articulate their understanding, and (3) guide the students toward the educational goals.

One move they identified was that the facilitator revoiced what the students said in a way that prompted them to move forward in their discussion (Hmelo-Silver, 2006). The facilitator also pushed students for an explanation through the use of open-ended questions (Hmelo-Silver & Barrows, 2006). When the discussion stalled or when the facilitator needed to be sure a student was involved, he would ask a student to summarize what they had discussed so far (Hmelo-Silver & Barrows, 2006). The facilitator in this study also encouraged the students to generate hypotheses to focus their inquiry and realize limitations of their knowledge (Hmelo-Silver & Barrows, 2006). Finally, the students were asked to draw a flowchart of their learning to demonstrate their ability to integrate their learning (Hmelo-Silver & Barrows, 2006).

Challenges. Although PBL has been used successfully for years in medical schools and has begun to gain popularity in K-12 education it has yet to be widely adopted by K-12 teachers (Ertner & Simons, 2006). According to Grant & Hill there are five factors that influence teachers' adoption and use of PBL, including:

> (1) Recognition and acceptance of new roles and responsibilities, (2) comfort in the new environment, (3) tolerance for ambiguity and flexibility in managing the new learning environment, (4) confidence in integrating appropriate tools and resources, including technology, and (5) integration of new pedagogies with realities beyond the classroom, including the ability to balance the unique needs of individual learners, teaching colleagues and administrators to name a few. (p.42)

Without enough guidance and support in these areas teachers might wrongly believe that just because PBL is interesting and engaging, students are learning the things they need to learn (Ertmer & Simons, 2006).

According to Ertmer & Simon (2006) challenges in the implementation of PBL most commonly relate to creating a culture of collaboration and interdependence, adjusting to changing roles and scaffolding student learning and performance. Ertmer and Simon (2006) offer suggestions supported by evidence and anecdotes for overcoming these challenges in the classroom.

Collaboration is a key component of a PBL learning environment. In order to take part in a collaborative group students must learn how to establish group goals, divide responsibilities, manage due dates, and deal with problems related to group dynamics (Ertmer & Simon, 2006). It is the teacher's job to facilitate these behaviors. Ertmer and Simon cited the use of "posthole" units as a strategy useful in helping students adjust to working within a collaborative environment. These posthole units are mini PBL units used to introduce students to the PBL method and to give students the time and

opportunity needed to practice working collaboratively in a small group (Ertmer & Simon, 2006). Ertmer and Simon (2006) also suggested conducting whole-class debriefings after small-group work is finished to afford students the opportunity to reflect on the group process itself. Finally, according to Ertmer and Simon (2006), requiring students to record group goals and related activities on learning contracts or daily worksheets can also help student to adopt a more collaborative mindset.

Another challenge teachers new to PBL might face is the transition from a directive more traditional role to a facilitative role (Ertmer & Simon, 2006). One way teachers can adjust to this new role is through the use of rituals which are essentially scripts that provide teachers with specific cues and procedures for managing and carrying out the phases of the PBL process (Ertmer & Simon, 2006). Teachers might also take the time to observe experienced PBL facilitators as well as use the aforementioned posthole units as an opportunity to practice facilitating (Ertmer & Simon, 2006).

The final challenge centers on strategies for scaffolding student learning and performance. Scaffolding refers to tools, strategies, or guides that support learners in dealing with complex tasks while simultaneously learning necessary content independently (Ertmer & Simon, 2006). It is especially important for facilitator's to overcome this challenge, as the bulk of their time will be spent initiating student inquiry and ensuring content learning (Ertmer & Simon, 2006). Ertmer and Simon (2006) differentiate scaffolding into two types: hard and soft. Soft scaffolds include those offered to students on a continuous basis such as conferencing (Ertmer & Simon, 2006). Whereas hard scaffolds are those that support learning needs that can be anticipated and

planned for in advance such as handouts or graphic organizers (Ertmer & Simon, 2006). According to Ertmer and Simon (2006), scaffolds can be used to accomplish four important goals within PBL: (1) initiating student inquiry, (2) maximizing student engagement, (3) aiding learners with concept integration and addressing misconceptions, and (4) promoting reflective thinking.

In order to successfully initiate student inquiry students must be engaged with the problem which research has shown can be difficult for students at the beginning of a PBL unit (Ertmer & Simon, 2006). If teachers are able to spark learners' interest as well as outline the requirements of the task at hand early on in the project, they are more likely to obtain student engagement sooner rather than later (Wood et al., 1976). Facilitators can spark student interest by showing past projects, allowing students the opportunity to "dig in", or demonstrating an engaging scientific principle (Ertmer & Simon, 2006). The process of presenting the requirements of the unit serves to make the task more manageable for the students (Hannafin, Land & Oliver, 1999). This can be accomplished by interspersing hints aligned with project requirements throughout the project, giving a grading rubric in advance, or creating the rubric with the students (Ertmer & Simon, 2006). Facilitators may also want to provide students with deadlines and graphic organizers that will lead them through the process (Ertmer & Simon, 2006).

To maintain students' engagement and encourage the productive use of group time facilitators must provide students with the opportunity to articulate their learning (Ertmer & Simon, 2006). This can be accomplished asking probing questions, challenging a student's argument or claim, or offering an alternate idea all of which force

students to interpret the information they have gathered (Ertmer & Simon, 2006). Teachers should also schedule frequent checkpoints with students to help keep them on track among other things (Challenge Based Learning: A Classroom Guide, 2012). Another aspect of student engagement that is often troublesome during a PBL unit is a student's excessive focus on completing tasks rather than on learning content (Ertmer & Simon, 2006). By continuously reminding students of the importance of linking claims and evidence and of the problem and task at hand facilitators can help keep students focused on the expectations for the unit (Ertmer & Simon, 2006).

Since one of the fundamental goals of PBL is to help learners gain a deeper understanding of content through the process of doing it is important to systematically help students make the connection between their inquiry activities and the content that needs to be learned (Ertmer & Simon, 2006). This has been a particular challenge for adopters of PBL (Ertmer & Simon, 2006). One strategy for ensuring students are learning the content is to require students to document their thinking throughout the inquiry process (Ertmer & Simon, 2006). Facilitators can then organize and respond to the thinking with prompts that help students connect their ideas to the project topics (Ertmer & Simon, 2006). Students might also be expected to explain their observations and support their theories with evidence. If they are unable to support their assumptions the teacher might engage in what is called a "time for telling" in which the teacher directly gives some portion of the information (Ertmer & Simon, 2006). When obvious misconceptions arise teachers can address them by asking students to explain their beliefs about a certain topic and then highlighting the inconsistencies in their thinking.

Because of the importance of deep content learning within a PBL unit it is essential that teachers and students do not lose sight of this goal as they focus on interesting and exciting activities that need to be completed (Ertmer & Simon, 2006). A strategy to help teachers keep deep content learning as a focus is the promotion of reflective thinking (Ertmer & Simon, 2006). The promotion of reflective thinking can be accomplished in several ways. Activities as simple as documenting student thoughts on the whiteboard during a class discussion or asking students to respond to a generic prompt (e.g. "Right now, we're thinking…") can support reflective thinking (Ertmer & Simon, 2006). Additionally, by providing students with a model (either live or videotaped) of someone else's thought process during the completion of a task or investigation can not only demonstrate the language of the discipline for students but can also prompt them to reflect upon their own processes in comparison with those of an expert or another student (Ertmer & Simon, 2006).

Summary. In summary, research indicates that PBL units containing the elements essential to the instructional method do have a positive effect on student content knowledge and the development of skills such as collaboration, critical thinking, and problem solving. It has been shown that students also benefit through increased motivation and engagement. Students will need support in setting up and participating in initial inquiry and in organizing their time to complete tasks although strategies for helping students to succeed in these areas do exist Additionally, project based learning can be challenging for teachers to implement, but with proper support and professional

development especially around known areas of difficulty teacher can enact PBL effectively.

Technology Integration

Technology is no longer only about engagement and fun in the classroom. In the 21st century, technology is about developing college and career ready information, literacy skills and personalizing learning for students (Project Tomorrow, 2013). Vygotsky's more knowledgeable other (MKO) was once a more advanced peer in the classroom or, more often than not, the teacher (as cited in Cicconi, 2013). These days this MKO is more than likely an adaptive computer program that creates individualized lessons for students or maybe a student half way around the globe (Cicconi, 2013). Students no longer need teachers and schools to gain access to knowledge and experience the world. They need schools and teachers to help them develop the tools they need to create content and share their discoveries with the world (Project Tomorrow, 2013). According to Brush (2007), computers not only provide students with opportunities that would be difficult to attain in other ways but also can help improve standardized test scores; improve critical thinking skills such as problem solving and inventive thinking; and improve motivation and self-direction in students.

So how can teachers integrate technology into their classroom to achieve these desired results? How can teachers avoid what November (2012) referred to as the "thousand dollar pencil" trap of using technology to just do work that could have been done without a computer? In this section I will describe, TPACK, a popular framework

for technology integration in the classroom. I will also discuss how various 21st century skills can be met more seamlessly through the use of technology.

TPACK Framework. TPACK is an acronym which stands for technological pedagogical content knowledge. It is a model for technology integration the builds on other pedagogical content knowledge constructs with the addition of the technology component (Koehler & Mishra, 2009). Because there is no one best way to integrate technology into the curriculum the creators of TPACK have worked to develop a framework that helps teachers to determine technology that is not only creative and structured but also appropriate to and complementary to the content being taught and pedagogy surrounding teaching and learning (Koehler & Mishra, 2009). The framework focuses on the interaction between content knowledge, pedagogical knowledge, and technological knowledge. To understand this concept of integration it is important to understand the individual parts.

Koehler and Mishra (2009) defined content knowledge as a teacher's knowledge about the subject matter to be learned or taught. Pedagogical knowledge is an understanding of the processes and practices of teaching and learning. A teacher with strong pedagogical knowledge understands how students learn and acquire skills as well as how to develop students who know how to learn and who want to learn (Koehler & Mishra, 2009). Because it is constantly changing and evolving, technological knowledge is more difficult to define. Rather than trying to pinpoint certain software or hardware a teacher should be familiar with in order to be considered technologically knowledgeable, Koehler & Mishra (2009), defined technological knowledge as a person's ability to

"understand information technology broadly enough to apply it productively at work and in their everyday lives, to recognize when information technology can assist or impede the achievement of a goal, and to continually adapt to changes in information technology." (p. 64). It is the integration of these concepts that transforms teaching and learning (Koehler & Mishra, 2009).

There are several ways in which these concepts can be integrated. Koehler and Mishra (2009) identified pedagogical content knowledge; technological content knowledge; technological pedagogical knowledge; and finally, technology pedagogy and content knowledge (TPACK) as the four ways in which we can look at these components. As teachers interpret the content of the subject to be taught and find multiple ways to represent it based on students' prior knowledge they are demonstrating pedagogical content knowledge (Koehler & Mishra, 2009). Technological content knowledge is a teacher's ability to determine which technologies, if any, are best suited for student learning of a particular subject matter (Koehler & Mishra, 2009). Technological pedagogical knowledge is a teacher's understanding of how teaching and learning are affected when particular technologies are used in particular ways. Included in this definition is a teacher's ability to look beyond the common uses of popular technologies to see how they might be used differently in an educational setting (Koehler & Mishra, 2009). Finally, Koehler & Mishra (2009) bring all three of these components together to form a framework to help teachers systematically integrate technology into their classrooms. This framework labeled technology, pedagogy, and content knowledge

(TPACK) is the basis for effective technology integration and according to Koehler & Mishra (2009) requires:

> an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones. (p. 66)

An understanding of these components and how they interact offers new opportunity for learning in the digital age.

Digital Learning & Web 2.0. In his book *Who Owns the Learning: Preparing Students for Success in the Digital Age*, November (2012, p. 14) stated the importance of teaching students to use information and communication technology to innovate, solve problems, create and be globally connected through collaboration, contribution and research. The skills he focuses on mirror the skills identified by the Partnership on 21st Century Learning as being essential skills for today's students. TPACK emphasizes the importance of systematically identifying what subject matter can be taught more effectively through technology than through traditional methods. Teachers must, not only determine skills that can be better taught through the use of technology but also determine which technologies will best provide students with the opportunity to engage in reading, writing and talking about texts and ideas. By exploring the array of Web 2.0

technologies available for adaptation to the classroom setting, teachers will have a good start in making these determinations. Web 2.0 refers to a second generation of World Wide Web that is focused on the ability for people to collaborate and share information online (Solomon & Schrum, 2014).

With the increased availability of Web 2.0 tools there has been a shift from a culture that focuses on individual knowledge to a participatory culture emphasizing teaming, collaboration and participatory learning (Lemke, 2010). Today's digital tools allow students to go far beyond the traditional paper which was written and then submitted to the teacher for a grade. Through the use of Web 2.0 tools such as blogs, microblogs and podcasts students have the opportunity to create and then share their final product with readers from around the world, motivating them to perfect their work for this authentic audience (Solomon & Schrum, 2014, p. 11). Students can now post ideas, brainstorm concepts, share research, collaborate on a project or request peer editing all in real time through the use of wikis, social media and productivity suites like Google Drive (Solomon & Schrum, 2014, p. 11). November (2014, p. 26) identified the use of screencasting and web publishing to facilitate peer tutoring among children from other classrooms, school, nations and backgrounds. These easy-to-use and often free technologies not only support communication and collaboration but a host of other 21st century skills as well.

Web 2.0 also offers students the opportunity to engage in learning that is multimodal and therefore engaging (Lemke, 2010). The use of text and/or sound combined with visuals positively shifts achievement by extending students' critical

thinking skills; deepening their understanding of core subject content; and providing a variety of opportunities for students to show what they know and what they are able to do (Lemke, 2010). Some examples of interactive multimodal activities include simulations, modeling, online gaming, interactive graphics, mind maps, animations, digital storytelling, video documentaries, and personalized learning resources (Lemke, 2010; Solomon & Schrum, 2014).

Finally, according to Lemke (2010) the internet has opened up a new opportunity for lifelong individual and group learning through the democratization of knowledge. Because of the low cost access to high-speed broadband available to the majority of students, they are able to engage in informal learning based on personal and/or community interests or needs (Lemke, 2010). Educators can authentically connect their students' formal and informal learning by helping them develop proficiency in critical thinking, information literacy and self-direction (Lemke, 2010). Web 2.0 tools that support the melding of formal and informal learning are online course units (flipped classrooms), virtual environments, and learning objects which are self-contained resources used to support learning (Lemke, 2010 and Solomon & Schrum, 2014).

Summary. In summary, in this section I have outlined the importance of thoughtful and strategic technology integration based on the content to be taught and best practices in teaching and learning. Although it is clear that the use of technology is engaging and necessary to promote 21st century skills, educators should be careful to use it to modify and redefine learning in the classroom, not just as a new tool to complete tasks that could be completed just as easily without a computer. Inexpensive and widely

available Web 2.0 tools such as blogs, social networks, podcasts, wikis, and productivity applications make modifying and redefining learning easier than ever for teachers today.

Conclusion

In my review of the literature surrounding 21st century skills, problem-based learning, and technology integration, several themes have arisen. First of all, today's students are not currently being prepared in schools for the jobs they will need to do in the future. Skills such as critical thinking, problem solving, collaboration, information and communications technology literacy and self-direction are in demand by employers but are not being taught in our schools. We can foster these skills, while maintaining true to state and national standards as well as core content, through the use of problem-based learning and thoughtful technology integration.

As stated earlier, this past year I started teaching in a school district that embraces inquiry and a student centered philosophy to teaching and learning. The district adopted a Units of Study curriculum that encourages many of the 21st century skills the literature I have reviewed has outlined. One of the main principles of this curriculum is based on the premise that students will use a variety of contexts to engage in reading, talking, and writing about texts and ideas and that students be exposed to new ways to process the ideas they have learned from both oral and written texts (Fountas & Pinnell, 2011). Although the district has adopted this curriculum and supports teaching practices that will help students achieve the core principles of the curriculum, they have offered teachers no systematic framework or strategy to use in the day to day implementation of the curriculum. Problem-based learning and the Web 2.0 tools that support it offer a strategic

framework for ensuring students leave 5th grade with the content knowledge and 21st century skills they need to succeed in middle school and beyond. Through the use of these two methods I hope to answer the question: How can I provide 5th grade students with opportunities to engage in reading, writing, and talking about texts and ideas across different instructional contexts using technology and problem-based learning?

In chapter three I will describe the basic theory used for developing my supplementary curriculum. I will include an outline of the format for the curriculum supplements I will be developing as well as an outline of the Unit of Study for which I will be developing the supplementary curriculum.

Chapter Three

Methods

Overview

The Units of Study curriculum adopted by my school district requires students to engage in reading, talking, and writing across a variety of contexts with an end goal of deeper learning and increased exposure to new ways to process the ideas. My district also has adopted a goal of creating the World's Best Workforce through a focus on 21st century skills. Unfortunately, the curriculum does not include direction on how this should be done, presenting the need for supplementary curriculum. Research has shown that a student's ability to transfer knowledge to new and different situations is a clear indicator of successful learning (Fountas & Pinnel, 2010). It has also been shown that students who engage with authentic problems and work towards real-life solutions exhibit more critical thinking and problem solving skills (p21.org). It is through the design of this supplementary curriculum that I will answer the following question: How can I provide 5th grade students with opportunities to engage in reading, writing, and talking about texts and ideas across different instructional contexts using technology and problem-based learning?

In this chapter I outline the methods I will use to design and create a curriculum supplement that will increase students' opportunities for reading, talking and writing across a variety of contexts. I will use an evidence based instructional framework when creating this curriculum supplement. I will illustrate the curriculum framework as well as

identify the intended audience for this curriculum. Finally, I will identify the assessment opportunities to be used throughout the curriculum supplement.

Participants

The curriculum supplement I have designed is intended for use in a fifth grade classroom. I teach in a suburban magnet school with an international studies focus. My school is one of four magnet schools and one of seventeen elementary schools in a large metropolitan area in the upper Midwest. The population of the school is seven hundred twenty students with twenty percent being eligible for free and reduced lunch. Sixty-seven percent of the students in the school are Caucasian, nine percent are multi-racial while Asian and Black students each make up eight percent of the population and five percent of students are Hispanic.

This curriculum supplement is intended for all students in the regular education classroom regardless of ability and, due to its flexible nature and student-centered focus, is applicable for use in any upper elementary school classroom. Fifth grade students in my school have a class set of thirty computers available to them but must share these computers with the other four fifth grade classrooms demonstrating the ability for a teacher to use Challenge Based Learning without a dedicated set of computers. The unit guide is structured in such a way that it can be adapted for use in any subject or grade. It is intended to be a guide to help any teacher restructure an existing unit into Challenge Based Learning.

Procedures

The curriculum supplement I created contains a unit guide for the fifth grade environmental science unit of study focusing on natural resources and surface changes. The unit focuses on the big idea and expected student outcomes that currently exist for the unit but will enlist additional components such as the identification of an authentic challenge; guiding questions, activities, and resources leading to a solution to the challenge; student evaluation of their solution; documentation and publishing of the process; reflection on the process; and assessment of learning. The systematic addition of these components which are accompanied by materials to support the process lead to a unit that truly gives students the opportunity to read, write, and talk about texts and ideas across many different contexts through the use of technology and problem-based learning.

Curriculum Model. The six-eight week supplement focuses on the 21st century skills necessary for students to be successful as they move through school and into the work world. The supplement adds a variety of authentic contexts through which students can engage in reading, writing and talking about their acquired knowledge on ecosystems. The supplement is designed around the Challenge Based Learning framework, which is meant to be an engaging multidisciplinary approach to teaching, and learning that encourages students to use 21st century skills and the technology students already use in their everyday lives to solve real-world problems (Challenge Based Learning, 2011).

The goal of the Challenge Based Learning framework is for teachers to work with students to take standards based content and connect it to authentic, real-world issues (Challenge Based Learning: A Classroom Guide, n.d.). Students collaborate with other students, teachers and experts in their community or around the world to develop deeper knowledge of the content they are studying. By identifying and solving for a real-life challenge and then sharing the solution with the community, Challenge Based Learning aims to provide students with an authentic purpose to deepen their learning. The Challenge Based Learning framework is divided into five stages (see table 1.)

Table 1

Five Stages of Challenge Based Learning

Stages	Description
Stage One	Big Idea to Challenge
Stage Two	Setting the Foundation for the Solution
Stage Three	Identifying a Solution
Stage Four	Implementation and Evaluation
Stage Five	Publishing Results and Reflections

(Challenge Based Learning Classroom Guide, 2011)

I chose Challenge Based Learning as the framework for my supplement because it incorporated all of the key elements of a successful problem-based learning program with the additional focus on integrating technology such as podcasts, blogs, videoconferencing and collaborative workspaces. Challenge Based Learning focuses on real-world problems that foster inquiry. This framework encourages student choice about ways to learn and share their understanding of the research. Students are required to collaborate; offer and

respond to feedback; and revise, modify and elaborate on their findings. These are all components of a successful problem-based learning program.

Design. The design of this unit plan follows the five stages of Challenge Based Learning and was created using the Understanding by Design template. Understanding by Design is the preferred curriculum design format used in my school and it helps to ensure learning activities are focused on intended student outcomes.

In a higher level classroom stage one of the Challenge Based Learning process might be completely student-centered. Because I am writing this curriculum for use in a fifth grade classroom in a school that is dedicated to meeting both district and state standards, stage one needed to be more teacher-centered. The first two parts of stage one, identifying a big idea and formulating an essential question, were non-negotiable and are dictated by the school district's curriculum and state standards. The third step of stage one which is the actual creation of the challenge was completed by me to ensure the formation of a realistic challenge that would be sure to include all the necessary student outcomes.

During stage two of the process students identify the guiding questions (what they need to know) they need to be able to answer in order to develop a solution for their challenge. Students also identify resources and activities that help them to answer these guiding questions. After having thoroughly researched the guiding questions the students have the background necessary to move into stage three and begin formulating possible solutions to their challenge. At this point students identify one solution to develop further and eventually implement, which brings us to stage four: implementation and evaluation.

It is at this point that students put their solution into action, analyze the outcome and reflect on what worked and what didn't. Students need to plan for how they will measure and gather information related to the success of their solution. Finally, in stage five students have the opportunity to publish their results and reflect on the process.

Assessment. Assessment for this Unit of Study occurs in the form of both formative and summative assessments and focuses on three areas: content knowledge, mastery of real-world skills, and the process of Challenge Based Learning. I assess student progress informally throughout the process as well as holistically in the form of a summative assessment at the end of the project. Informal assessment will take place throughout the unit and will occur in the form of student conferences, journals and interim reviews of student work based on checklists and/or rubrics. A summative assessment of the students' completion and implementation of the solution based on a rubric will occur at the end of the project. Students will also participate in the district summative assessment for the unit of study, which is designed to assess content knowledge. Guiding prompts to be used during informal conferencing as well as the rubrics and/or checklists that will be used for assessment will be available in the appendixes.

Ethics

Since the curriculum writing process I am embarked upon did not involve minors, students, fetuses, pregnant women, prisoners, in vitro fertilization, mentally disabled persons or subject deception of any kind I was able to complete the exempt Human Subjects Committee short form requiring only basic information about my research. I

have obtained prior consent from my principal and district. Additionally, because I am not gathering student information or observing student behavior there is no need for me to draft a letter of consent for parents.

Summary

I have designed a curriculum supplement that provides fifth grade students with an opportunity to engage in reading, writing and talking about texts and ideas across a wide variety of contexts by using problem-based learning supported by technology. Embedded in this curriculum supplement is the need for students to engage in 21st century skills to accomplish the task at hand. This six-week supplement supports an existing unit of study on natural resources and surface changes and is designed for use in a fifth grade regular education classroom in a southeastern suburban international studies magnet school.

The supplement follows the Challenge Based Learning framework and was written using the Understanding by Design template. The beginning stages call for more active participation from the teacher and require that the teacher guide the process by making decisions, communicating information, teaching skills and answering questions about how the process works and what is expected of students (Challenge Based Learning: A Classroom Guide, 2011). In the middle stages, teachers gradually release some of the responsibility to the students. Students work on their own to plan and research while the teacher acts as a mentor helping students navigate difficult spots (Challenge Based Learning: A Classroom Guide, 2011). In the final stages of Challenge Based Learning students are engaged in their own work while the teacher checks for

mastery of required skills and knowledge (Challenge Based Learning: A Classroom Guide, 2011). Students will be assessed both formally and informally at various stages in the process.

In chapter four I will describe the process I used to write the attached curriculum supplement. I will also describe the Unit Guide I have written and provide a detailed summary of the learning activities the Unit Guide contains. I will discuss the challenges I encountered while writing the supplement as well as some surprise findings I uncovered.

Chapter Four

Results

Overview

The purpose of this supplementary unit guide was to expand on the curriculum put in place by my school district so that fifth grade students in the elementary school in which I teach are given the opportunity to, not only learn the standards that are set for them, but to engage in reading, writing and talking about texts and ideas across many different contexts. Providing students this opportunity is a key component of the district's Units of Study curriculum which is based on the work of Fountas and Pinnell (2010). The school district also places a strong focus on the teaching of 21st century skills such as learning and thinking skills; information and media literacy skills; life skills; academic content knowledge; and knowledge of various interdisciplinary themes (p21.org). Additionally there is a heavy emphasis on the integration of technology in classrooms though the use of the technological pedagogical content knowledge (TPACK) framework.

Unfortunately the Units of Study curriculum the district has in place does not provide a clear picture of just how teachers can meet these varying goals. In writing this supplementary unit guide it was my hope that I would answer the questions: through the use of problem-based learning and technology integration I could provide the fifth grade teachers in my school, as well as other schools, with a framework that not only provides the opportunity for students to engage in reading, writing, and talking about texts in many ways but also encourages and teaches 21st century skills and keeps the TPACK

framework in sight. Challenge Based Learning is the perfect trifecta of standards, 21st century skills, and technology integration which is what made it the ideal framework for creating this supplementary unit plan.

In this chapter I will describe the process I used to develop a Unit Plan that answers the question: How can I provide 5th grade students with opportunities to engage in reading, writing, and talking about texts and ideas across different instructional contexts using technology and problem-based learning? I will first describe the framework I used to guide thinking. I will then review the Unit Guide and describe, in detail, the learning activities that make up the Unit Guide.

Curriculum Framework

An essential element to creating this supplementary unit guide was to integrate the expectations and standards set forth by the school district and the state with activities that foster 21st century skills and responsible technology integration. The first step in creating this unit plan was to research evidence based learning frameworks that were student-centered but also flexible enough to be adapted to elementary classrooms and allow for enough teacher support to make the students successful. Through research in developing the literature review and conversations with my professor at Hamline University, I found problem-based learning and eventually landed on an iteration of PBL called Challenge Based Learning.

With the guidance of the Challenge Based Learning framework I was able to create a supplementary unit guide that not only meets the essential Minnesota State Science Standards for fifth grade but also incorporates engaging and interactive

instructional strategies and various opportunities for students to apply their learning in new and different, relevant, real-life situations both of which are crucial to mastering 21st century skills according to McTighe and Seif (2010). The unit supplement I created also encourages students to ask questions, discuss ideas, give feedback and share their thoughts and opinions, all of which are necessary in a classroom that supports the learning of 21st century skills (McTighe & Seif, 2010).

Challenge Based Learning, and therefore this unit plan, also encourages students to use technology, not only as a way to broaden their learning by reaching out to experts in the field they are studying, but to also collaborate and share their learning with one another as well as the world at large. As stated in the literature review for this capstone, computers should provide students with opportunities that would be difficult to obtain in other ways (Brush, 2007). November (2012) warned against the "thousand dollar pencil" trap of using technology to do work that could have been done without a computer. This supplement promotes the use of Web 2.0 tools such as blogs, podcasts and videos to provide students with the experience of reading, writing and talking about texts and ideas across many contexts which is an important component of the Units of Study curriculum in place in my school district. This component of our curriculum cannot be met without the strategic use of technology.

Unit Guide

I wrote this unit guide using the Understanding by Design template. I chose this template because of its focus on identifying a big idea, essential question, and student understandings as well as assessment opportunities. The inclusion of all four of these

components is not only important to me as a teacher but is also fundamental to problem-based learning (Barell, 2010) as well as to my school district's curricular philosophy. This template has also been used regularly throughout the past ten years as the preferred template for other supplementary curriculum written by teachers in my school.

At the beginning of the unit guide are detailed student understandings that relate specifically to state science standards as well as understandings related to the Challenge Based Learning process (Challenge Based Learning: A Classroom Guide, n.d.). The understandings specific to the Challenge Based Learning process are those that also address 21st century skills. In the first section of this unit plan, you will also find the Essential Question for this particular Unit of Study as well as the Challenge students will need to work towards solving.

The second section of the unit plan addresses the final product for the project as well as the various forms of assessments that are used throughout the project to determine whether students gained the necessary content knowledge, real-world skills, and Challenge Based Learning process knowledge necessary for successful unit completion. Barell (2010) stressed the importance of summative and formative assessments in a PBL unit and Savery (2006) added that since the goals of PBL are both knowledge-based and process-based, assessment of both at regular intervals is necessary. This unit plan suggests places to incorporate summative assessments throughout the project in the form of conferences, learning logs, journals, and/or blogs. Rubrics and checklists outlining the expectations for these assessments are located in appendix B of this capstone. Students

are assessed formatively at the end of the project, on all aspects of the project, through the use of a rubric that is included in appendix B of this capstone.

The final portion of the unit guide, the summary of learning activities, outlines the learning activities that will take place over the course of the project. The unit guide I have written is just that: a guide. Problem-based learning, including Challenge Based Learning, is student-centered, making a rigid set of lessons and activities counterproductive to the spirit of the curricular theory (Barell, 2010 & Savery, 2010). The summary of learning activities is divided into the five stages of Challenge Based Learning (Challenge Based Learning: A Classroom Guide, n.d.). Each stage is further broken down into a series of activities that are meant to help teachers facilitate the process and guide students towards new learnings and understandings. This idea of teacher as facilitator is key to the success of a true problem-based learning framework (Savery & Duffy, 1995). Many of these activities refer to supporting documents that can be found in appendix B of this capstone. The supplementary unit guide itself can be found in appendix A.

Summary of Learning Activities. The learning activities in this unit guide are broken down according to the five stages of Challenge Based Learning.

Stage One. The first stage has been adapted to not only accommodate the goals and standards of my district's curriculum but to also scaffold the framework for use in an upper elementary classroom. Challenge Based Learning is most commonly used in middle and high school settings although there are increasing numbers of elementary schools that use the framework. As I conducted research for this capstone during the

literature review, a common theme that arose was that of scaffolding to meet the needs of your students (Ertmer & Simon, 2006).

In order to streamline the process and ensure an Essential Question and Challenge that fit with state and district standards, I took the liberty of formulating both rather than working with students to accomplish this task. Because of this, stage one in my unit guide starts with an introduction to the Big Idea through read aloud texts and open inquiry. My research during the literature review for this capstone stressed the importance of posing a Challenge that is real world and ill-structured to increase student motivation to find a solution (Savery, 2006). I worked very hard to create a Challenge that was real-world, ill-structured, and could be solved locally but also had global implications (Challenge Based Learning, 2011). My research also stressed the importance of reviewing grading and assessment expectations as well as due dates very early in the process (Challenge Based Learning: A Classroom Guide, n.d.). Therefore you will also find schedule and assessment review in the first stage of the unit guide.

Stage Two. During stage two of the unit plan students are collaborating in small groups to determine what they need to know in order to create a solution to the Challenge and how they are going to learn what they need to know. They are formulating the questions they will need to be able to answer to develop a solution to the Challenge and then determining resources that will help them answer these questions. It is also during this stage that students research the answers to their questions using the list of resources they developed, all while keeping the Essential Question and Challenge in mind. Research I conducted during the literature review stated how imperative it is to a PBL

program that students are aware of what they do and do not understand (Hmelo-Silver, 2004). It is for this reason that stage two of the unit plan incorporates teacher conferences, individual reflection, student-centered small-group work, and teacher-centered large group work to ensure students are on the right track.

Success during stage two requires the ability for students to collaborate within a small group using skills such as listening, reasoning together and building on each other's ideas which are key elements to a successful PBL program (Barell, 2010). Additionally, these learning and thinking skills are an essential part of the 21st century skills framework (Dede, 2010; p21.org). This stage also requires students to use collaborative software (our district's Google Docs system, Collaboration Station in this case) to take and share their notes with one another creating, what my research during the literature review portion of this capstone called, a participatory culture that emphasizes teaming, collaboration and participatory learning all of which are also part of the 21st century skills framework (Dede, 2010; Lemke, 2010; & p21.org). Finally, it is during stage two that students are utilizing various Web 2.0 tools such as podcasts, videoconferencing and blogs to gather information about the Essential Question as well as to share what they are learning. Research has shown the importance in giving students the opportunity to use information and communication technology to innovate, solve problems, create, and be globally connected through collaboration, contribution and research (November, 2012).

Stage Three. Stage three of the unit plan requires students to synthesize the research they have gathered to come up with possible solutions to the Challenge. Once students have come up with several viable solutions they must pick one and create an

action plan for how they will implement the solution. The action plan serves as an opportunity for the teacher to offer feedback so students can make necessary adjustments and the teacher can assess the academic content learning that has taken place thus far both of which are necessary to the teacher's job as facilitator (Barell, 2010,Challenge Based Learning: A Classroom Guide, n.d.).

Stages Four and Five. The final two stages of the unit guide are made up of implementation, publishing, and reflection. Once the students have submitted an acceptable action plan they will implement their solution. Once they have implemented it according to their action plan students will publish, in video format, the results of their project including several other details regarding the project. This video will then be posted for the world to see. According to the research I conducted during the literature review phase of this capstone, these two activities are important for several reasons. The ability for students to apply the results of their research to actually implement their solution is essential to the authentic nature of a PBL unit which is what makes this type of learning so motivating (Barell, 2010). Publishing the results of the solution as well as a description of the challenge and what the group learned serves as an excellent assessment tool for teachers and adds to the authenticity of the project (Barell, 2010; Savery, 2006; & Challenge Based Learning: A Classroom Guide, n.d.). Finally, the research I conducted for the literature review illustrated the point that students need schools and teachers to help them develop the tools they need to create content and share their discoveries with the world (Project Tomorrow, 2013). By requiring students to collaborate on this type of

performance task, this unit guide fosters responsible technology integration as well as the learning of 21st century skills necessary to create such a product.

In addition to offering another opportunity for students to practice sharing and publishing through the use of technology, the reflection portion of stage five offers students an opportunity to self-reflect. Much of the research I read during the literature review for this capstone focused on the importance of students taking responsibility for their own learning and the value in giving students the opportunity to share their thoughts and opinions (McTighe & Seif, 2010 & Savery, 2006).

Final Thought. One final thought I would like to share on the learning activities that make up this unit guide is that although all of the activities are supported by the research on problem-based learning and responsible technology integration, the activities also support one of the main goals of the Units of Study curriculum already in place in my school district. All of these activities give students the opportunity to engage in reading, writing, and talking about texts across many different contexts which is one of the goals of my current curriculum that I have struggled with the most.

Summary

I have designed a unit guide to supplement the fifth grade Geography and Environmental Science Unit of Study already in place in my district. This unit plan uses a research-based learning theory and the thoughtful integration of technology to provide the fifth grade students in my school with an opportunity to engage in reading, writing and talking about texts and ideas across many different instructional contexts. I have provided this opportunity by creating a six-eight week unit plan in which teachers serve

as facilitators to their students' learning journey. The unit consists of learning activities that will serve to guide students through their journey and help them deepen their learning. I have also created various documents, some for teacher use and others for student use, that complement many of the activities found in the unit plan.

In the next chapter I will identify limitations and challenges I faced while writing this unit plan. I will also give recommendations when using the curriculum and using a more student-centered teaching model in an upper elementary classroom. I will end the section by reflecting on the process and curriculum I have developed.

Chapter Five

Conclusion

Overview

The Units of Study curriculum adopted by my school district requires students to engage in reading, talking, and writing across a variety of contexts with an end goal of deeper learning and increased exposure to new ways to process their ideas. My district also has adopted a goal of creating the World's Best Workforce through a focus on 21st century skills and thoughtful technology integration. Unfortunately, the curriculum does not include direction on how this should be done, presenting the need for supplementary curriculum.

Research has shown that a student's ability to transfer knowledge to new and different situations is a clear indicator of successful learning (Fountas & Pinnel, 2010). It has also been shown that students who engage with authentic problems and work towards real-life solutions exhibit more critical thinking and problem solving skills (Barell, 2010 & p21.org). It was through the design of this supplementary unit guide that I answered the following question: How can I provide 5th grade students with opportunities to engage in reading, writing, and talking about texts and ideas across different instructional contexts using technology and problem-based learning?

I have designed a unit guide to supplement the fifth grade Geography and Environmental Science Unit of Study already in place in my district. This unit guide uses a research-based learning theory and the thoughtful integration of technology to provide the fifth grade students in my school with an opportunity to engage in reading, writing

and talking about texts and ideas across many different instructional contexts. I have provided this opportunity by creating a six-eight week unit plan in which teachers serve as facilitators to their students' learning journey. The unit plan consists of learning activities that will serve to guide students through their journey and help them deepen their learning. I have also created various documents, some for teacher use and others for student use, that complement many of the activities found in the unit plan.

In this chapter I will discuss the limitations of using problem-based learning and technology in the classroom. I will also provide recommendations for those considering using the Unit Plan I have created. Finally, I will offer my reflection on my learning throughout the process of writing this capstone.

Limitations

It is no secret that authentic, real-world learning is motivating to students, and I think you would be hard pressed to find teachers who think 21st century skills such as problem-solving, collaboration, global awareness, communication, and personal responsibility are not important. The issue many teachers have arises in the research for the teaching of 21st century skills in schools that I read for the literature review although it is not presented as a limitation in the research. Teachers today are faced with too much content and not enough time to teach it all (McTighe & Seif, 2010). For this reason it is difficult for teachers to integrate new pedagogies with realities beyond the classroom, including the ability to balance the needs of individual learners, teaching colleagues, and administrators (Ertmer & Simons, 2006). Many teachers simply don't have the time or

motivation to adjust to changing roles and create the culture of collaboration necessary to implement PBL in its true sense.

Additionally, through my research and own experience when developing this unit plan I found the sheer number of technologies available and the speed in which they become obsolete to be overwhelming. Because it is constantly changing and evolving the technological knowledge aspect of TPACK is defined not in terms of specific hardware or software but as a person's ability to understand information technology broadly enough to apply it and recognize when it can assist or impede the achievement of a goal, and to continually adapt to changes in information technology (Koehler & Mishra, 2009). Lack of time and resources can severely limit the breadth of technologies teachers present to their students. If what I learned during the literature review is true and teachers must not only determine skills that can be better taught through the use of technology but also determine which technologies will best provide students with the opportunity to engage in deeper learning, a stronger emphasis must be placed on professional develop surrounding technology.

Another challenge I found when designing this unit guide was resisting the urge to develop a more scripted, teacher-centered, traditional lesson plan. It was difficult to walk the line between offering enough scaffolding and facilitation to guide the students to success and creating a situation in which the only "answer" students could arrive at was the one I had in mind. The transition from a directive, traditional role to a more facilitative role is one I personally found difficult and anticipate being a challenge for others as well.

The final drawback I found was creating a Challenge that is realistically doable for fifth grade students. Much of the research on PBL has been done at the middle school, high school and college levels. Although it is gaining popularity in elementary schools the Challenges do require a certain level of maturity not always found in elementary students. Students at this age cannot be alone outside of the school or sometimes even outside of the classroom, making the implementation phase difficult. The gathering of materials needed for the solution falls on the parents or teachers when implementing at this age as students don't often have the resources to obtain materials themselves.

Recommendations

In addition to following the activities outlined in the unit guide and utilizing the scaffolds provided in appendix B, I would suggest integrating scaffolds for helping students to successfully initiate inquiry and focus their research. Scaffolding surrounding time management and the productive use of technology would also be a useful addition to a unit like the one I have written. Thomas (2000) sited these as common issues teachers face when implementing a PBL unit. Because of the student-centered nature of Challenge Based Learning it is difficult to say when and where scaffolding in these areas would be most useful, requiring teachers to be on the look-out for those "teachable moments" when conferencing with students or after reviewing learning logs, journals, and/or student blogs.

Another recommendation I would make based on the research I compiled for the literature review as well as my own experience teaching in a fifth grade classroom and writing this unit plan is to create your own Essential Question and Challenge when

implementing a unit at the elementary level. Many of the opponents of PBL state research that favors PBL over traditional teaching methods when it comes to motivation, problem-solving and self-directed learning but not when it comes to content knowledge (Ertmer & Simons, 2006). Establishing a strong Essential Question and Challenge that directly relate to the content that needs to be mastered helps to focus the project and ensure the necessary standards are being met.

If I were to complete this capstone differently, I would like to further study and determine the effectiveness of Challenge Based Learning as presented in the unit guide. I would like to know how the prospect of solving of a real-life, authentic challenge effects the motivation of students who are typically considered unmotivated. I would also like to have researched more specific scaffolds to use throughout the unit. As I said earlier, PBL suggests scaffolds based on teacher observed student needs. If I were to revisit this capstone after implementing the unit plan I would have a better idea of which areas would require the most scaffolding for elementary students all the while knowing scaffolds would vary year to year based on the needs of the students in the classroom.

Reflection

As an upper elementary school teacher I find the lack of motivation and excitement surrounding school and learning to be disheartening. I find the pressure to produce students who are not only academically literate but who are also collaborators, communicators, problem-solvers, innovators, globally aware, etc. to be overwhelming. Over the years I have spent countless hours creating webquests that were essentially a list of websites in a pretty package. I have searched for social skills curriculums to teach

students how to work together. I have looked for supplements to make the various science curriculums I have taught over the years more exciting and relevant for my students.

It was through the research done for the literature review of this capstone and the writing of this unit guide that I realized there are options in which students and teachers learn to use technology together. It is possible for students to learn social skills such as collaboration and personal responsibility "on the job". And, finally, it is not my job to create relevant and exciting experiences for students. These types of experiences exist right outside our doors. It is my job to make my students aware of these opportunities and provide them with the tools they need to make a difference. It is my job to show students how mastering the academic content that makes up our standards and expectations can give them the power to make real changes in the world around them.

I feel this unit plan along with the supplements I have created to support it will give future teachers and researchers the support they need to give this type of "teaching" a try. I hope this capstone becomes a resource for other elementary teachers looking for a way to adapt their curriculum or standards to incorporate Challenge Based Learning or other problem-based learning frameworks.

Appendix A

Natural Resources and Surfaces Changes Supplementary Unit Guide

Fifth Grade Natural Resources & Surfaces Changes Unit Guide

In this unit guide you will find evidence based activities and supplementary materials to use in the facilitation of a fifth grade problem-based learning unit on natural resources & surface changes. The unit plan addresses a variety of the Minnesota State Science Standards for fifth grade and contains graphic organizers, rubrics and activities that have been adapted from the Challenge Based Learning Classroom Guide. You will find individual, small, and large group activities in this lesson guide and will notice a student-centered theme.

The activities in this guide were designed to give teachers a framework to work within. The Essential Question and Challenge were created with Minnesota State Science Standards for fifth grade in mind and will need to be adapted if different standards need to be met. This guide also contains activities that are specific to the Units of Study curriculum in place in my school district. These activities may need to be adjusted to fall within the parameters of curriculum in place in other districts.

The activities are organized into the five stages of Challenge Based Learning. The activities are designed to take place over a 6-8 week period of time with the assumption that 60-75 minutes a day are being dedicated to the process. Timing may vary depending upon how much direct reading instruction is being integrated into the process. It should also be noted that the activities in this guide assume the use of at least one computer per group of students although it is ideal that each student has his or her own computer. Teachers may find there to be supplementary skills that need to be taught before students are able to complete an activity. Supplementary skills might include lessons on technology use or on working collaboratively.

This unit guide is designed for use in a fifth grade general education classroom. The activities in this guide aim to provide students with authentic, real-world tasks that are motivating and engaging. The activities require students to use technology as a tool to accomplish tasks and reach audiences they wouldn't otherwise be able to without its use. The activities are also designed to promote 21st century skills such as collaboration, problem-solving, personal responsibility, critical thinking, communication, contextual learning and information and media literacy. Finally, it is important to note that these activities and assessments are designed to be carried out with the teacher serving as a guide or facilitator rather than as the more traditional, teacher-centered role.

STAGE 1 – DESIRED RESULTS

Big Idea: Sustainability in our Community

Understandings: *Students will understand that…*	**Essential Questions:**
• soil is created as a result of rocks weathering and combining with organic matter • humans decisions impact the earth positively or negatively • various processes shape and form the earth. There are slow and rapid processes	• How does the rainwater run-off affect our water supply both locally and globally? **Challenge:** • Reduce the impact of rainwater run-off at Diamond Path or another location in our community.
Students will know: • The impact of individual decisions on natural systems • How to use tools and techniques in gathering, analyzing and interpreting data • How to plan a scientific investigation such as a field study or open-ended exploration	Students will be able to: • reflect on the impact humans have on the earth as well as ways to make positive choices regarding the earth • students can identify slow and rapid processes that change the earth and how they change the earth • work collaboratively to obtain information needed to solve the Challenge • reflect on the process of developing a solution to their Challenge

STAGE 2 – ASSESSMENT EVIDENCE

Performance Tasks:	**Other Evidence:**
• student used data generated from the implementation of his/her solution to create a short written report or video	• learning logs, journals, and/or blogs • conferences • self-evaluations

presenting their findings • student produces a clear and concise perspective of what was learned about the topic, specific content, and processes presented in written or video journal	• content assessment
Key Criteria: • see attached rubrics	

STAGE 3 – LEARNING PLAN

Summary of Learning Activities

Stage 1

Introduction

- Introduce the Essential Question and the Challenge. Stress the importance of the Challenge as it relates to the students personally as well as how it relates globally. Share a current news story, event, etc. to help stress the importance of the issue.
- Review Diamond Path's internet usage policy & internet search tips
- Place students into mixed ability groups of 4
- Students spend 1-2 days doing general inquiry surrounding the Essential Question and Challenge to build interest and excitement and to start developing some background about the Essential Question and Challenge (see attached list of suggested websites and books). Notes from inquiry should be taken in paper journal or on Collab.
- Teacher conducts 2-3 read-alouds related to sustainability and main understandings. Read-alouds also serve to introduce the topic and incorporate nonfiction literacy skills (see attached book list).

Schedule, Project Rubric, & Assessment

- Go over project schedule as a class. Students fill in dates as we go (see attached schedule). Stress that dates are just a guide and will be flexible
- Go over the Project Rubric (see attached)
- Review expectations for on-going assessments throughout the project: learning logs, journals, and/or blogs; conferences; and self-evaluations/reflections (see attached expectations)

Stage 2

Guiding Questions: What do we need to learn in order to effectively devise a solution to this challenge?

- Have students independently write down what they already know about the Essential Question and Challenge. Then, share out as a whole group.
- Now ask students what they will need to learn in order to effectively devise a solution to this challenge. Encourage students to think in terms of who, what, when, where, why, and how type questions.
- Students work in their small groups to brainstorm what information they will need to gather in order to solve the challenge. What questions will they need to answer in order to form a solution to this challenge?
- Students should add their ideas to the Guiding Questions, Resources, & Activities Matrix shared with them on Collab. One student can be responsible for typing in the questions as well as for sharing the matrix with the rest of the group.
- Come together as a class to share small group brainstorming lists. Community writing: synthesize each individual group's list into one large list to form our official Guiding Questions. Students should revise their group's list to match the class list.

Guiding Activities: How will we learn it?

- Analyze our list of Guiding Questions. Determine resources and/or strategies for how we will learn each one. Students have already had some time to browse books and/or websites but should come up with other resources for answering their Guiding Questions as well.
- As they come up with resources in their small groups the one student should add the resources to the group's Guiding Questions, Resources, and Activities Matrix.
- Come together as a large group for a Community Writing session. Synthesize all ideas into one main classroom list. Students should revise their Guiding Questions, Resources, and Activities Matrix (attached) to match the classroom list.
- Teacher contributes resources students might not have come up with. If applicable, be sure students think about conducting not only basic web searches related to the challenge but also surveys, opinion polls, expert interviews, calculations, experiments, etc.

Researching Answers

- Students now have the opportunity to find the answers to their Guiding Questions.
- All answers should be entered onto the Guiding Questions, Resources, and Activities Matrix in the Results (What we learned) section.
- Once a group finds an answer to one of their questions they should

schedule a conference with the teacher to check in and discuss.
- It is also during this research stage that students must be maintaining their learning log, blog, or journal according to the expectations outlined at the beginning of the project.

Stage 3

Brainstorming Possible Solutions

- Once students have researched and answered all of their Guiding Questions, they can start thinking about possible solutions to the Challenge. Remind students they must use their research findings to identify the best possible solutions.
- After looking at a variety of solutions that might work for the Challenge each group needs to select one they think will work the best. Encourage students to select their solution only after prototyping, experimenting, sketching, etc. the possible solution. The group also needs to take the time and resources available into consideration when selecting a solution.
- Once a group has decided on a solution they must schedule a conference with the teacher before moving on.

The Solution

- After gaining approval from their teacher, each group must develop an Action Plan (attached) for developing and implementing their solution. The Action Plan must include the research backing their solution (why is this a viable option?); what is the anticipated impact of this solution (how will it help?); materials needed; how will materials be obtained; permissions needed; how will success be measured; how will data be collected (qualitative vs. quantitative); outline the steps for implementation; how will results be shared.
- Once a group completes their Action Plan, they must schedule a conference with the teacher for approval before moving onto implementation in stage 4. Implementation will be based off this Action Plan so this is a very important step and it is crucial the Action Plan be well laid out. If it is not, the teacher needs to work with the students to identify weak spots in the Action Plan.

Stage 4

Implementation/Evaluation

- Now is the time for each group to implement their solution and evaluate it for success. Each group should implement based upon the steps they listed in their Action Plan.
- Each group will conduct their data collection for the specified amount of time, being sure to document and record (in Collab) their measurements

at the times they have determined on their Action Plan.

- Once the data collection period is over, the group will compare their beginning and ending data to determine if any change occurred. Did their solution have the desired effect?

Stage 5

Publishing the Results

- Each group must now present their project in its entirety. Show students several examples of solutions videos before setting them on their way. https://www.challengebasedlearning.org/challenges
- Each group's video must include a description of the Challenge, a description of what the group learned, the solution, and the results of the solution. The goal is for the video to be 3-5 minutes long.
- Before beginning the filming of their video, each group must complete a storyboard and script (template attached) to help them create an organized video. Once the storyboard and script are complete, the group should set up a conference with the teacher for approval. Once they gain approval, they can begin filming.
- Completed videos will be exported for the world to view.

Reflection

- Each student must individually create a reflection video outlining what they as an individual learned about the content and process as well as what their overall experience was like
- Students should follow the Video Reflection Requirements & Rubric (attached) to be sure they have included all necessary information.

Appendix B

Unit Guide Supplements

Sustainability: Natural Resources & Surface Changes Websites

Explore the following websites. Be sure to keep our Essential Question and Challenge in mind at all times! Refer to Guiding Questions, Resources, and Activities Matrix to guide you and help you stay on track.

How to Create a Rain Garden

Rain Garden Plants

Preventing Run-Off

Stormwater Run-Off Information

Techniques to Slow or Stop Run-Off

Run-Off and Erosion #1

Understanding Run-Off and Solutions

Run-Off and Erosion #2

Run-Off and Erosion #3

Is Run-Off a Problem?

Erosion

Weathering

Erosion

Stormwater Run-Off for Kids

Stormwater Run-Off Animation

Stormwater Run-Off Interactive

Water Pollution Games & Activities

Polluted Run-Off

Stormwater Education for Kids

Stormwater Management for Kids

Stormwater Matters for Kids

Run-Off Video

Sustainability: Natural Resources & Surface Changes Books

A True Book: Hurricane Katrina	Peter Benoit
A True Book: Soil	Christin Ditchfield
A True Book: The Exxon Valdez Oil Spill	Peter Benoit
Cleaning up Litter	Nancy E. Harris
Compost Basics	Mari Schuh
Composting	Buffy Silverman
Crumbling Earth: Erosion & Landslides	Mary Colson
Different Kinds of Soil	Molly Aloian
Earth Day	Mir Tamim Ansary
Earth's Resources	Sue Barraclough
Earthquakes	Cy Armour
Extreme Weather	Ann O. Squire
Fires	William B. Rice
Green Homes	Saranne Taylor
Green Living: No Action too Small	Lucia Raatma
How does a Volcano become an Island?	Linda Tagliaferro
How does a Waterfall become Electricity?	Mike Graf
Hurricanes	William B. Rice
Microlife That Lives in Soil	Steve Parker
Minerals, Rocks, and Soil	Barbara J. Davis
Oil Spills	Heather Hammonds

People Change the Land	David Bauer
Protecting the Planet: Environmental Activism	Pamela Dell
Rock Cycles: Formation, Properties, and Erosion	Rebecca Harman
Rocks and Soil	Charlotte Gullain
Saving the Environment	Jessica Cohn
Slow Changes on Earth	Nicolas Brasch
Soil	A. D. Richardson
Soil	R. & L. Spilsbury
Storm	David Booth
The Earth's Resources: Renewable and Nonrenewable	Rebecca Harman
The Environment	Louise Spilsbury
The Worst Volcanic Eruptions	Suzanne Garbe
This is our Earth	Laura Lee Benson
Three Cheers for Trees! A Book about our Carbon Footprint	Angie Lepetit
Tornadoes and Hurricanes	Cy Armour
Using Rocks	S. Katz Cooper
Using Water	S. Katz Cooper
Volcanoes	Cy Armour
Volcanoes	William B. Rice
What's Sprouting in my Trash: A Book About Composting	Esther Porter
Why do Glaciers Grind?	Helen Bethune
Why Should I Recycle	Jen Green

Wild Water Floods Tony Allan

Learning Logs, Journals, and/or Blogs Checklist

Student must:

- complete three entries per week, with the final entry being completed by Friday
- share each entry with the teacher once it is completed
- submit an entry that is at least one paragraph long…remember a paragraph is 5-7 sentences
- include one thing that is going well
- include one thing that they and/or their group could use help with
- include at least one new learning related to the Essential Question and/or Challenge
- include at least one question you have

Student Name _____ **Week of** _____

Learning Log, Journal, and/or Blog Contains:	1st Weekly Entry	2nd Weekly Entry	3rd Weekly Entry
Paragraph			
Going Well			
Help			
New Learning			
Question			
Total Points	/15	/15	/15

Does Not Meet Expectations	1 point
Partially Meets Expectations	2 points
Meets Expectations	3 points
Exceeds Expectations (Extra Credit)	4 points

Project Schedule

Note: The following project schedule is only a sample. Dates may be adjusted for any number of reasons. This schedule should be viewed a guide only and should be allowed to flex as needed.

Activity	Target Due Date
Introduction	September 21-24
Schedule & Assessment Review	September 25
Development: Guiding Questions	September 28-30
Development: Guiding Activities	October 1-2
Research	October 5-9
Brainstorm: Possible Solutions	October 12-13
Solution Action Plan	October 14-16
Implementation	October 19-November 2
Evaluation	November 3-5
Publishing Results	November 6-10
Reflections	November 11-13

Project Rubric

Student Name _____

	Beginning (1-2)	Developing (3-4)	Exemplary (5-6)
Guiding Questions	Narrow set of questions.	Questions represent what is needed to learn in order to identify a solution to the challenge.	Questions represent what is needed to learn in order to identify a solution to the challenge and are aligned with the Essential Question and/or Challenge
Guiding Activities	A range of activities all primarily within the classroom	A wide range of activities both inside and outside of class that help to answer the guiding questions. Lead to an innovative, insightful, and realistic solution.	A wide range of activities both inside and outside of class that help to answer the guiding questions. Lead to an innovative, insightful, and realistic solution. Aligned with the EQ and/or Challenge
Guiding Resources	Sources are reliable and accurate	Sources are reliable and accurate. Represent a wide variety of perspectives.	Sources are reliable and accurate. Represent a wide variety of perspectives. Include interaction with local, national, and/or international experts
Solution	Solution shows evidence of careful research	Solution shows evidence of careful research and deliberation. Can be implemented by the students	Solution shows evidence of careful research and deliberation. Can be implemented by the students. Involves partnerships with

			groups outside of the school
Implementation	Solution is implemented a specified amount of time	Follows a detailed action plan. Solution is implemented for a specified amount of time with some data collection	Follows a detailed action plan. Solution is implemented for a specified amount of time with extensive data collection
Evaluation	Conclusions are drawn using the data generated from the implementation	Conclusions are drawn using the data generated from the implementation. Findings are presented in a clear manner in a written report	Conclusions are drawn using the data generated from the implementation. Findings are presented in a clear manner in a written report and a short video
Reflection	Clear perspectives on what was learned about the topic, specific content, and process. Presented via classroom discussion	Clear perspectives on what was learned about the topic, specific content, and process. Presented in a written journal or blog	Clear perspectives on what was learned about the topic, specific content, and process. Presented in a written journal or blog and video journal
Score			

Total ____/42

Guiding Questions, Resources, and Activities Matrix

Student Name _____

Guiding Questions (What we need to learn)	**Guiding Activities and Resources** (How will we learn it)	**Results** (What we learned)	**Does it relate to the Essential Question and/or Challenge**

Solution Action Plan

Group Members _____
_____

Describe your solution (2-3 sentences): _____
_____
_____
_____

Why is this a good solution? Include research you have found that supports your solution.

_____
_____
_____
_____
_____

What is the anticipated impact of this decision? In other words, how do you think this solution will help?

_____
_____
_____
_____
_____

List the materials you will need to implement your solution. Next to each material tell how you will get it.

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

How will you be able to tell if your solution is successful?

_____
_____
_____

_____
_____

How will you collect data to determine if your solution is effective?

_____
_____
_____
_____
_____

List the steps you will take to implement your solution. Add on to the back if necessary.

1.

2.

3.

4.

5.

6.

7.

8.

9.

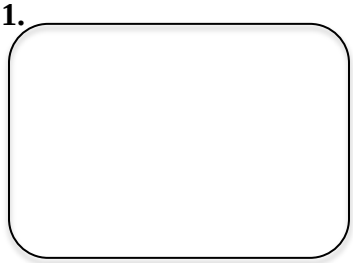
10.

Teacher Signature _____

Solutions Storyboard

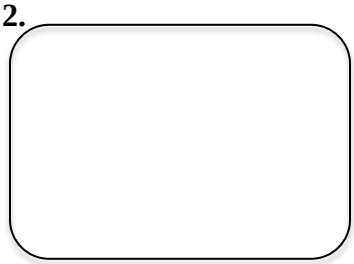
Students should use the large box to sketch their ideas, the smaller box for production notes, and the lines below for dialogue.

1.



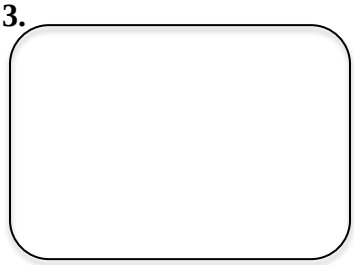
Team Info: Team name, country, state, school,

2.



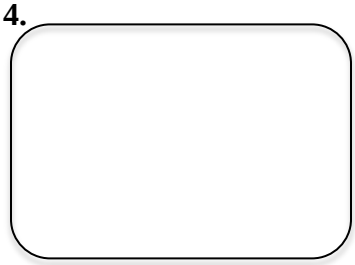
The Challenge: State the Challenge

3.



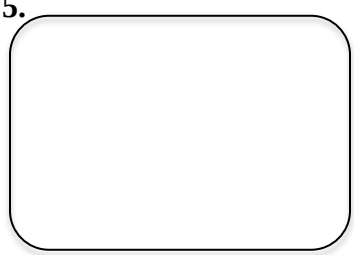
Process: Overview of what your group did to learn about the Challenge.

4.



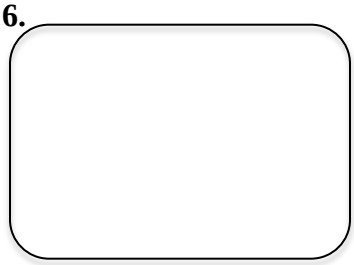
Solution: State your solution

5.



Implementation: Tell how, where, and with whom the solution was implemented.

6.



Lessons Learned: Present what you learned

Reflection Video Requirements & Rubric

Student Name _____

The reflection video should answer the following questions:

1. Why is this important to you and your community?
2. What kinds of surprises did you encounter during your research?
3. Why do you think your solution will make a difference?
4. How did you measure the effectiveness of your solution?
5. What have you learned about collaboration?
6. What would you do differently if you were to take on this challenge again?
7. What skills did you learn that apply to other areas of your learning?

Question	Points
Why is this important to you and your community?	
What kinds of surprises did you encounter during your research?	
Why do you think your solution will make a difference?	
How did you measure the effectiveness of your solution?	
What have you learned about collaboration?	
What would you differently if you were asked to take on this challenge again?	
What skills did you learn that apply to other areas of your learning?	

Does Not Meet Expectations 1 point

- Question was not addressed

Partially Meets Expectations 2 points

- Question was addressed but not clearly answered

Meets Expectations 3 points

- Question was answered completely

Exceeds Expectations (Extra Credit) 4 points

- Question was answered completely and showed deep understanding

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