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Abstract

This paper explores the theories that govern three processes of learning: project-based, problem-based and self-regulated. One of the critical questions that this paper addresses is: how can these three processes be utilized to plan an effective unit? Studies have shown that students benefit motivationally from various inquiry-based models of instruction. These models mirror authentic tasks performed in the real world and engage the students in an in-depth way that compels them to use higher order thinking skills. Self-regulation is a set of necessary skills students must use to prepare and perform these types of tasks. As one studies these three processes, patterns and similarities begin to emerge that can be utilized for unit design and planning. In response to the literature reviewed in the paper, this researcher submits a planning method incorporating these three processes that is both manageable and sensible. This design will come in six stages: the driving question to start the unit, a personal project for problem solving, a personal delivery of the solution, group placement and negotiation, group project planning and group project showcase.

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CHAPTER I: INTRODUCTION

Why are we learning this? The question often arises in classrooms across the world, and it is a good question. I often asked it myself when I was in school. For me, it was math. I could not fathom the practical, everyday use for what we were learning beyond the basics. I didn't know what an engineer did. I didn't know what the job of scientist actually entailed. These things were abstractions, and so were the tenets of mathematical instruction.

This lasted all the way to university when, in a pre-teaching service block, I took a course on mathematical instruction for elementary students. For the first time in my life, I was interested in the math I was learning. I could see the practical application for the methods described in the class. I was motivated to learn and to do well.

Upon reflection, my difficulties in mathematics stemmed from my disinterest. I didn't understand the reasons for math, and so it seemed like more of a chore. The subject itself was isolated without a larger context. If I were to fail at math, it was fine. That was only one subject out of a larger catalogue from which I excelled at several other disciplines.

As a teacher, I understand that getting my students interested in what they're supposed to be learning is one of the most difficult and important steps in the process. I must, effectively, sell the curriculum; affecting and developing their interest in a topic of which they know either nothing or very little. In order to do this, I have to appeal to their sense of meaning. They must understand why they are learning about a topic to make it a meaningful endeavor. It may not be that I can give them a realistic, everyday application for each and every concept, but there has to be enough relevance to their world so as to understand the reason they're learning it.

Problems are an effective method through which to engage students actively in their own learning (Roopashree, B.J., 2014). A problem is a way of situating a concept into a scenario that enlists creative thinking. Students must apply a certain degree of base knowledge to that scenario and devise a means of solving that problem. The creative element stems from that fact that most problems have more than one solution. This is not a bad thing. The students in any classroom think and reason differently from each other; they have differing life experiences and ways of working through problems. No one path is deficient necessarily so long as they address the issue at hand.

A project is an artifact by which learning and experience is showcased. The project itself is meaningful and integrates many different disciplines together as a culminating effort to capstone a sophisticated unit of study (Blummenfeld, Soloway, Marx, Krajcik, Guzdial & Palincsar, 1991). Most are collaborative in nature and require a degree of communicative skills and research. This, again, caters to students' varied interests and strengths; some are creative writers, others may be mavericks at organization, yet some others may be gifted orators. All of these roles may be necessary to complete one project, and all of them add value to the in-depth unit study.

Project-based and problem-based processes are highly student-centered and inquiry driven. Both have been used in education for decades, and both have been effective learning tools to engage students in meaningful lessons that require an expression of learning; what we call authentic assessments.

Authentic assessments are realistic; they mirror the tasks that professionals do each day, and they incorporate the means with which they carry out those tasks. These ideas are not new. They were founded, in part, by the works of John Dewey and other constructivist thinkers nearly a century ago. The problem with education, Dewey argued, was that skills were being taught in isolation (Bell, 2010). How could students be prepared to understand the broader concepts necessary to identify a problem and create a solution if they were only being taught isolated skills with no driving purpose to marry them together? It did not help that many of these isolated skills were taught through a series of low-level tasks. Students were "afforded few opportunities to represent knowledge in a variety of ways, pose and solve real problems or use their knowledge to create artifacts" (Blumenfeld et al., 1991, p. 370).

While a more problem-based method was introduced to educate medical students at higher levels of education, it has quickly seeped down to secondary and primary classrooms. The reason being, that creating an environment where students need to think critically about actual problems, engages their interest and prompts them to think creatively. While this is a noteworthy goal, is not enough. Students must not only become engaged, they must remain engaged for as long as the task demands.

The best motivator for a student is himself. Outside forces that compel them into action may work for a time, but ultimately inspiration must come from within. During any given problem and project, a student must take the lead in monitoring him own progress or that of their collaborative group. They must set goals for themselves based upon the ones introduced with the concept. They must find a degree of independence to push past the notion of doing as little as possible in order to get the grade. These are the tenets of self-regulated learning (English & Kitsantas, 2013). While this can be relatively easy, providing the task involves something that they wanted to do anyway, it is often not the case.

Projects and problems are more sophisticated in nature and require a higher degree of engagement and thought. As much as teachers like to think that students want to always be performing at this higher level, this is not often the case. As much of a grind as a steady stream of low-order tasks can be, they are much simpler and their expectations on achievement, easier to manage.

Definitions

Important definitions to this paper:

Constructivism: the theory that education is best achieved through understanding and knowledge of the world.

Project-based learning: a constructivist approach utilizing inquiry methods culminating in the production of an artifact.

Problem-based learning: a constructivist approach utilizing inquiry methods to solve problems with many possible solutions.

Self-regulated learning: a method of instruction whereby students take control of their own learning and motivation (Saks & Leijin, 2013)

Driving question: a problem to be solved that drives the unit of inquiry

Mastery Goal Orientation: the desire of a student to reach a deeper understanding of material due to genuine interest (Green & Miller, 1996)

Performance Orientation: a student's desire to perform well to be better than others (Green & Miller, 1996)

Research Question

The critical questions drawn upon to initiate my research were how best to utilize both project- and problem-based learning as a method of unit planning. Additionally, I sought to understand how student self-regulation could be married to both of these concepts in order to form comprehensive planner for student-centered instruction. Finally, I wanted to find a way to account for all three components and create a useful strategy for both individual and collaborative efforts.

I first delved into project-based learning and its history in education. I looked at the step-by-step process through which other authors delineated the stages of this inquiry process. I then followed suit with problem-based instruction and found the similarities and differences of both processes. Lastly, I looked at how self-regulated learning could fit into the stages of both. In my application project, I have created a staged procedure that incorporates each of these components, the expectations of both the students and the teacher, and a template that can be used to design units with all of the processes mentioned above.

The application project includes sections devoted to creating driving questions with which to initiate this style of unit, as well as formative assessments that can be used along the way. Finally, I have included a rubric that can be used to ensure a unit plan of this nature meets the desired specifications. It is my hope that this template can serve as a means of instruction for teachers that enjoy designing inquiry-based, interdisciplinary units. This type of planning may not be practical for every concept that needs to be covered over the course of a school year, but it can be utilized as a means of instruction for much of them.

CHAPTER II: LITERATURE REVIEW

Project-Based Learning

Project-based learning has had a long history. It was early in the 20th century, when the educator and philosopher John Dewey proposed inquiry as a basis for learning. Dewey felt that "students will develop personal investment in...material if they engage in real, meaningful tasks and problems that emulate...real-world situations" (Krajcik & Brumenfeld, 2006, p.318). This thinking was first applied to medical students who, to that point, were primarily educated through direct instruction. Dewey had a very constructivist view of education. He "regarded the interaction between the subject and the world with all its complexity as essential for gaining knowledge" (Scheer, Noweski & Meinel, 2012, p.2). The process of opening up the students to more authentic forms of problem-solving tasks was seen as a more effective and engaging forms of instruction. Over the years, this type of instruction lent itself to a grander scope in education from universities all the way down to elementary schools.

Over the last few decades, researchers have found that project-based learning influences positive results in many realms of student learning; the foundation of which involves being active construction. As stated by Sawyer, active construction holds that "only superficial learning occurs when learners passively take in information from teachers, a computer or a book" (Sawyer as quoted in Krajcik & Brumenfeld, 2006, p. 318). In depth learning, on the other hand, is an authentic form of situated learning; where the students pursue more authentic forms of research. This has been replicated in science classrooms, in the form of experiments, for quite some time. Similarly, mathematics classrooms use cognitive tools such as graphs and data charts that analyze information much in the same way as professionals. Perhaps most importantly, project-based learning is developed around social interaction which helps learners develop their skills in learning, debating and sharing ideas. (Blumenfeld, Marx, Krajcik & Soloway, 1996).

Design Principles

Project-based learning is a broad term. It is complicated by the fact that many teachers routinely use projects as a means of assessment or as a one-off task to be completed by students after the actual content knowledge has been taught and assessed. Project-based learning, however, is a systematic teaching method (Mergendoller, Markham, Ravitz & Larmer, 2006) and therefore the means through which curriculum is taught. The essential structure of the curriculum is to incorporate the desired standards into "relatively long-termed, problem-focused and meaningful units of instruction that integrate concepts from a number of different disciplines" (Blummenfeld et al., 1991, p. 370). These units are structured around complex, authentic questions and carefully designed products and tasks (Mergendoller et al., 2006). The project-based learning method has five, distinct, design principles that must be elaborated upon.

The first principle of project-based learning starts from a desired question. These questions can be formed by the teacher alone or with student input. Driving questions must be feasible, ethical, contextualized, meaningful and worthwhile (Krajcik, Czerniak & Berger, 2002). This question is designed around a real-world problem; one that the students can see a tangible reason for and engage with on a personal level. This helps students understand the reason why they are doing the project and create the need for research (Mergendoller et al., 2006).

The second is scaffolding. Students explore the driving question and then engage in collaborative activities that are scaffolded with learning technologies to help them interact with the material at, or just beyond, their current level of learning (Mergendoller et al., 2006). The need for scaffolding is manifold: students require assistance with research methods and other data collection, they need encouragement and coaching to develop a deep understanding of the project, and they must be guided through the process of reflection.

Projects are collaborative in nature, and that collaborative effort drives the third principle. Students work both with other students in the class and with their teachers during the various stages of the process. This collaborative process helps to create a learning community with which they share information, present data, formulate conclusions and work through the problem in a manageable way (Brown & Campione, 1994). All of this aids the individual student in developing a deeper understanding of the material. A deep understanding goes beyond the content knowledge to a reproducible representation of that knowledge in the form of a model or artifact.

Artifacts are the focus of project-based learning and the fourth principle. An artifact is an external representation of the student's constructed knowledge (Blumenfeld, et al., 1991). These items can be manifested in many different ways. They can be represented physically as an artistic or scientific creation, or by using technology as in a video, audio recording, website or game. The means of presenting this constructed knowledge can also be altered to match student preference. So long as the artifacts "address the driving question, show the emerging understanding of students, and support students in developing understanding associated with the learning goals of the project", (Krajcik & Blumenfeld, 2006, p. 327) they will be effective.

The final principle of project-based learning is the reflection process (Mergendoller et al., 2006). Ideally, students will be reflecting throughout the research and design phase. On the students' part, this reflection will entail a degree of self-monitoring and other management details discussed later in this paper. The teacher must not only plan and implement the project, but must also "maintain student engagement over an extended period of time in a way that pushes principled understanding rather than simply appealing to students' desire to tinker with their projects" (Barron, Schwartz, Vye, Moore, Petrosimno, Bransford & Zech, 1998, p. 276). Reflection is, like much of the project-based learning process, for both teachers and students. Students can reflect upon their contributions to their collaborative groups, they can assess the reasons for the successes and failures they experienced along the way, and they can compare the results of other collaborative groups to their own. These help students absorb the total learning process. Teachers, similarly, must analyze their own contribution to the students' efforts and reflect on their own effectiveness.

Motivation and Metacognition

How does a teacher motivate students? The question is highly variable to the classroom and the teacher, but one factor that demonstrably influences student motivation is interest (Blumenfeld, et al., 1991). If a student is not interested in or can't relate the task to their, then what is the point of carrying out the task? Many students do not find school to be particularly engaging, some find it downright boring. Much of this has to do with the traditional structure of the learning that takes place in school; lessons are often taught in isolation with little connection to applications that exist beyond the school day, and those that are must often be sidelined for standardized test prep. The focus of a traditional education is the narrowing of scope from broad and transferable to specific and specialized.

Project-based learning alternatively promotes a link between different subject matter disciplines and presents an expanded, rather than a specific, view of subject matter (Blumenfeld et al, 1991). A student's interests in project-based learning are catered to in a number of ways: the tasks are varied, there is a progression from one stage unto the next, there is a sense of closure in the form of a student-created artifact, and the structure of the project itself is authentic. All of these elements are designed to enhance student interest and involvement.

Additionally, the students experience is not limited to that of a cognitive one. As stated above, these projects are often collaborative in nature, requiring them to use communication and social skills throughout the process. Collaboration is only the umbrella under which other metacognitive goals are realized. Examples of this include negotiation with other members of the group, revision processes for improvement, and self-evaluative techniques for assessing progress.

Moreover, the nature of the projects often has a component of self-monitoring in which students design an "organizational blueprint...for themselves as a guide to stay focused and on-task" (Bell, 2010, p. 40). This promotes self-reliance, accountability and organization, rather important goals set by the modern day school system. Project-based learning has been implemented in a variety of contexts throughout education. Though these programs may not fit the precise framework as listed above, Dewey's initial ideas on constructivist approaches to learning at are the center of these relatively modern philosophies.

Problem-Based Learning

The overriding characteristic of problem-based learning is that real life is messy. There is no package in which large problems can be wrapped. The world is complex and engaging. Situations can change as time goes by and new information is learned. There is no set formula to answer every problem that arises. Real life must be fully engaged with, and the hunt for solutions should be immersive (Savery & Duffy, 1995). Problem-based learning tasks are characteristically ill-structured; their borders and standards are loosely defined, and students must seek to find their own meaning within them. This ill-structure is meant to engage student imagination, "they catalyze critical and creative thinking, and...demand decisions based on sound criteria... [there are often] conflicting interests and incomplete information" (Torp & Sage 2002, p.2). The problem comes first, then the learning.

Like project-based learning, much of the initial stage of problem-based learning is centered on structuring a question to drive research. The role of the teacher at this stage is knowing the curriculum and designing a problem that adheres to the standards addressed within. They must then develop student interest in the problem. To draw students in, the driving question should be relatable and realistic. Students engage with the problem at their current level of understanding (Savery & Duffy, 1995), and, as responsibility increases, so does their motivation and ownership of the learning (Savery, 1999). Much of the drive for problem-based learning rests on the student's ability to determine what it is they already know in relation to the problem and what they will need to know in order to search for a solution.

The search itself, unlike in problem-based learning, is unguided by the teacher. Students must be aware of the tools necessary for research, and they must be able to discern credible sources. Like PBL, the research can be collaborative in nature; therefore students can draw from the experiences of their peers as they hunt for and categorize information. As the process of problem solving goes on, "the root problem or puzzlement may change, opening up new avenues of investigation" (Torp & Sage 2002, p. 20). If these puzzlements change, as they often do, the solutions that students come up with may be varied, but the value of the process is based more in the immersion during the problem solving and the skill with which student reached that solution.

Problem-Based Learning vs. Project-Based Learning

In the research, project- and problem-based learning are sometimes used collectively. At other times, the two seemed to be confused or oddly defined so as to make their distinctions problematic. The difficulty is that both stem from the same constructivist philosophies, both practices are cited to have originated from the same initial need in medical science education (Savery 2006), and they have quite a similar constructivist philosophy of learning; the students must be provided with an authentic learning experience to best process information. This, of course, is not to mention the most obvious confusion; the identical acronym and first-word similarities.

Various distinctions exist in the literature between each practice. Savery, for instance, cites the differences by setting the role of instructor or tutor, "in [project-based learning] the teacher is both the facilitator and provider of information...in problem-based learning the tutor does not provide information related to the problem...that is the responsibility of the learners" (Savery 2006, p.11). Others noted that, while project work is more directed to the application of knowledge, problem-based learning is more directed to the acquisition of knowledge (Perrenet, Bouhuijs & Smits, 2000). While these two suffice to create a definite separation between the two practices, the more obvious distinction is in the names themselves; project-based learning (PBL) is centered around the idea of long-term, artifact creation, whereas problem-based learning (PbBL) is more focused on the process of problem solving.

The outcomes for both are very similar. They are both based on self-directed, collaborative, multidisciplinary learning (Perrenet, et al., 2000). Both emphasize the constructivist philosophy of 'learning by doing'. As a series of strategies, both forms of instruction present students with an authentic learning continuum within which to explore, enrich, expand and express the experience of learning, and the combination of PBL and PbBL is a realistic strategy with which to build curriculum and enhance learning.

Means of Assessment in PbBL and PBL

With objectives and tasks that can bring such a varied array of outcomes to the table, special care must be taken in assessing these learning strategies. Because the nature of project- and problem-based learning leads to a greater connection between the student and the material of study, the means of assessment given by the teacher must "contribute more to effective learning, not merely to lead to marks and grades" (Roopashree, 2014, p.11). Many teachers, when initially confronted with the idea of assessing these strategies, use more traditional curriculum approaches. These approaches may lead to a "misalignment between their objectives and the student learning outcomes, the learning and teaching methods adopted and the assessment of student learning" (MacDonald, 2005, p. 85). Both approaches are designed to mimic that of real-world situations and thus "crucial assessments should be performance-based, holistic [and allow] for plenty of scope for students to input their own decisions and solutions" (Biggs & Tang, 2011, p. 237).

Examples of assessment techniques often include presentations (MacDonald, 2005). These may be either in a group or individual. Depending on the length of the project, there may be time for both. Group presentations can often be difficult to assess as different group members may contribute less or more to the overall presentation. This issue can often be solved by assigning (or allowing students to select) appropriate roles within the group so that each member has a section they have specialized in to present. The focus of the presentation will be different depending on the learning strategy used. In PbBL, student presenters will focus on one possible solution to or management of the initial problem, whereas in PBL the focus will be more directed toward displaying and showcasing the product resulting from the driving question. In either case, presentations allow students to both visually and auditorily showcase the learning process (Gyu Kim & Lee, 2014)

Written text variations can also form an authentic means of monitoring and assessing (MacDonald, 2005). These can be done online using tools such as Google Docs and classroom forums or in a journal. Documents can be built up over a number of weeks and shared with other students in the groups. Group members can read one another's texts and give feedback. Utilized as a means of assessment, the teacher will use this document as a running record to account for student learning and collaborative skills.

Assessment is not necessarily limited to teachers. With self-assessment, students judge their own work and performance. Peer performance can be made both within and beyond the project or problem group. This type of assessment can be "highly informative for [the] student and tutor...to give feedback before completing the final piece of work for submission" (Roopashree, 2014, p.13). Collaborative assessment involves both the teacher and the student in discussing the criteria by which the student will be assessed and negotiating the grade for final outcome. These variations should be used throughout the project or problem process as "giving and receiving feedback is an important aspect of student learning [and in]...professional contexts" (Roopashree, 2014, p. 13)

In all cases, the guidelines for PbBL and PBL assessment should follow the examples described by MacDonald and Savin-Baden (2004): Assessments, they cite, should be based on actual contexts; they should be based on what professionals perform in their own practice; they should reflect the student's development over the course of the task, problem or project; and there should be some component of self-assessment and reflection.

Self-Regulated Learning vs. Self-Directed Learning

In both PbBL and PBL, there is an underpinning of independence on the part of the students. Large sections of the problem or project rely on students being on their own, working towards the solution to the driving question. In order to be successful, "students must take responsibility for the learning process by setting goals, monitoring, reflecting and sustaining their motivation" (English & Kitsantas, 2013, p. 128). This is not some innate skill that many students possess. Like all worthwhile skills, this must be taught, scaffolded and maintained with teacher assistance.

A foundational definition for self-directed learning (SDL) is described as "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying...resources for learning, choosing and implementing learning strategies, and evaluating learning outcomes" (Saks & Leijin, 2013, p. 191). This definition has been reformulated over the years to avoid confusion with different dimensions of the process. The emphasis in SDL is on the external characteristics of an independent, self-motivated individual.

Self-regulated learning (SRL) is the students' cognitive and metacognitive approach to the process described above. In SRL, students carry out the activities that will lead them to SDL. In short, students become self-directed by practicing self-regulation. Students who are initiated in self-regulation are active in their own learning processes meta-cognitively, motivationally and behaviorally (Jossberger, Brand-Gruwel, Boshuizen & Wiel, 2010).

Self-Regulated Learning

As has been previously discussed, project- and problem based environments require a high level of student self-motivation and monitoring. These processes, in part, are learned skills. Simply initiating one of these learning processes may not be sufficient to properly motivate students to carry out the task. Quite the opposite, many teachers that attempt to utilize PBL and PbBL report "lack of motivation, lack of ability to take responsibility...and negative attitudes"

(English & Kitsantas, 2013, p. 131) on the part of the students when beginning to transition into the process. Part of the problem is the assumption that students are predisposed towards the higher order thinking skills required in both processes. This is not necessarily the case. Many students, in fact, find lower order tasks preferable as they require less overall effort on their part and produce the same traditional results (Blumenfeld, et al., 1991). They are, however, innately curious. Teachers using SRL techniques in instruction seek to use that curiosity to promote independence and motivation.

In the SRL classroom, students are supported in generating their own strategies for addressing and solving problems. This must be a purposeful process. Students may, initially, show reservations about engaging in higher order thinking processes, especially when they are used to more direct forms of instructions. Research has shown that, when teachers intentionally scaffold instruction on students' ability to learn independently and then "gradually fade out the level of instruction, [they]...become more comfortable in the environment" (English & Kitsantas, 2013, p.132).

SRL consists of many cognitive, behavioral and metacognitive processes. Cognition, in this case, refers to elaborative and organizational processes (Ocak & Yamac, 2013). They must plan and set goals for future learning and research. There are self-imposed deadlines and benchmarks to be met. Metacognition refers to the student's ability to regulate and evaluate one's own learning through the experience they have on their own and with a group; they monitor and evaluate themselves at different points in the process (Corno, 1986). The behavioral element comes from the need for students to control themselves in an environment with much more open-ended and collaborative norms than a traditional classroom. As students observe and reflect on their own involvement in the processes of different learning environments, they must seek to understand the reasons for certain outcomes. These are important aspects of the self-regulation process.

Self-regulation has been associated with many benefits to student learning. Researchers have demonstrated that "students who were high in self-efficacy and intrinsic value were more likely to report the use of cognitive and self-regulatory strategies" (Shannon, Salisbury-Glennon & Shores, 2012, p. 5). This is understandable considering that when students appreciate the value of a task and present an overall positive attitude toward that task; they are more likely to be motivated to do well. Additionally, a student's performance on a given task will, indelibly inform their attitudes towards their performance. This can take on many different forms depending on the result, but the important factor here is a student's understanding of the connection between these two variables.

Motivation and Self-Regulation

In terms of motivation, researchers readily make the distinction between mastery goal orientation and performance orientation (Green & Miller, 1996). Mastery goal orientation can be defined as a student's desire to learn and get a deeper understanding of the material because they genuinely want to. Performance orientation is based around the student wanting to perform better than others or up to some extrinsic expectation. In regards to self-regulated learning, mastery goal orientation has been positively related to high level cognitive strategies (Green & Miller, 1996). The use of which may be related to achievement. Similarly, classes structured around goal orientation increase the likelihood of student taking up the practice. Teachers emphasize these processes by using "collaborative or other forms of group learning, more learner-centered approaches to instruction, an emphasis on effort and improvement, and more authentic, individualized assignments and assessments" (Shannon et al., 2012, p.9).

SRL has not only linked to motivation and the use of cognitive practices, numerous studies have "demonstrated the benefits of self-regulated learning to academic performance" (Shannon et al., 2012, p.4). These include numerous studies by Zimmerman and Martines-Ponz (1990, p.8) including one on high school students where "by combining the teacher's ratings factorially with standardized achievement test scores, it was possible to separate students' achievement outcomes associated with their use of self-regulated strategies from their general ability." In these studies, students that displayed an awareness of and an inclination to self-regulate showed a greater propensity to accomplish tasks on time and at a higher level of acumen than those that did not.

Design of Self-Regulated Learning

What does this look like as an actual teaching methodology? The tenets of SRL are similar and can be aligned quite well with those of PbBL and PBL. The basic design follows a gradually increasing release of responsibility from student to teacher and then back to teacher. The first process is that of forethought. This phase stems from task analysis and motivational beliefs (Zimmerman, 2000). With task analysis, students must grasp the expectations and demands for the given project or problem, and review their own prior knowledge as it relates to that project or problem. Motivational beliefs involve "activating thoughts and feelings needed for motivation [and] generating vision" (English & Kisantas, 2013, p. 134).

In the second phase, students "engage in complex learning tasks, such as choosing their own path to learning, constructing meaning, reflecting, incorporating feedback, and revising their ideas" (English & Kisantas, 2013, p. 135). This phase can be rather complex for teachers to manage, as they must rely on students to motivate themselves through much of this process. A teacher's role during this performance phase is relatively hands-off, but providing feedback for students and giving options for making their learning visible can help students through this phase (Linn, 1995).

The third and final phase of SRL is all about reflection. Students can reflect on their performance over the course of the assignment and evaluate their product as it relates to the criterion expectations outlined by the teacher. Students also learn how other students approached the problems or projects and compare their peer's outcomes with their own. They may also "assess whether they are satisfied with their performance and identify adjustments that need to be made in their efforts to learn, such as seeking help from peers or the teacher" (English & Kisantas, 2013, p. 136)

Conclusion

From the research, it is apparent that there is a common link that threads through project-based, problem-based and self-regulated learning. All three processes emphasize major themes for the students: independence, collaboration, intrinsic motivation, higher-order thinking, planning and reflection (Krajcik & Blumenfeld, 2006; English & Kisantas, 2013; Savery, 1999). None of these can happen automatically for all students. A teacher must be responsible for the management of these processes (English & Kisantas, 2013). To be used effectively, these are the result of "thoughtful planning, pervasive management activities, established learning expectations and classroom procedures" (Mergendoller et al. 2006, p. 584) including project/problem creation, multiple scaffolds and a sound reflective process.

In both PBL and PbBL, students must have a degree of self-regulation. They must use these techniques to better understand and motivate themselves to complete the project, and they must be aware of what they need to know (Zimmerman, 1990). Teaching and learning of SRL principles can be aligned quite easily with both PBL and PbBL as delineated into three stages by

English & Kitsantas (2013): project/problem launch, guided inquiry, project/problem conclusion. The initial stage is devoted to the driving question. This question must be complex and have many different possible outcomes and solutions. In order to answer, the students must go through the processes listed above. The SRL component at this stage on the part of the students is to activate their prior knowledge and create a vision for the project/problem completion. They must formulate an idea of what will be necessary to reach a possible solution. With PbBL, this solution does not necessitate a product to construct in any physical sense, but the student learning may produce physical and visible products to demonstrate learning along the way. With PBL, this driving question will eventually result in a product and, while the final artifact may change as the research into the driving question goes forward, the initial idea of what can be produced by the student is an important first step (Mergendoller et al. 2006).

The second phase of both processes, the guided inquiry, is the portion where SRL is given the most weight (English & Kitsantas, 2013). This is the performance stage where students independently or collectively research the problem/project and test their ideas. In this phase, there is evidence gathering, the application of logic and reason. Students use prior knowledge on the credibility of sources and learn to disregard those that may not be as credible as others. They must manage a variety of strategies and monitor their own progress. It is in this stage that teachers must support student's problem solving, help with information filtering, collaboratively group students and adapt assessment as needed. The teacher must "intentionally elicit the students' articulation of thoughts, reasoning and processes...and ensure students are linking their activities to their learning goals" (English & Kitsantas, 2013, p. 136).

The final stage in both PbBL and PBL is a presentation of a solution or product (Savery, 2006; Krajcik & Blumenfeld, 2006). This stage matches the SRL stage of self-reflection.

Students must look back over their progress during the first two phases. This phase of self-judgment, coupled with peer assessment and other such assessment practices mentioned above can help to contribute to student self-efficacy and future motivation (English & Kitsantas, 2013).

CHAPTER III: APPLICATION MATERIALS

Introduction

After reviewing the literature and examining the use of project and problem-based learning in the elementary classroom context, I have come up with a template for the integration of project-based and problem-based methods into a self-regulated process for independent learning. This template is meant to serve any subject or field of study and, while my own experience has been within the elementary classroom, can be used in many different levels of instruction. This template is based on the works of Tilchin and Kittany (2016) that I will refer to throughout this section. Furthermore, I draw largely from other inquiry-based unit planning structures such as Understanding by Design as outlined by Wiggins & McTighe (2005).

The tools included in this section are designed to be used on a unit of inquiry in any curriculum. Organizing the inquiry into these two distinct sections allows for students to engage both individually and collaboratively with material, and further delineation of both sections into six, progressive stages makes the planning stages of the unit easier to use. The initial PbBL section is meant to ground the student in their own self-formation and knowledge of the material, while the PBL section affords them the opportunity to collaboratively work with their peers heterogeneously or homogeneously and create a product performance task. Students learn accountability throughout the process, both to themselves and to their peers.

Structure for Planning

The basic structure of the plan comes in two stages. Each of these is further broken down into three separate sections that I will discuss at length below. The general flow of the template is rather straightforward: a driving question leads students to independent, problem-based solution finding and, based on that research, student groups are constructed to create a product that addresses the need created by the initial driving question (Tilchin & Kittany, 2016). While this template would typically involve projects and problems that take a greater length of time than most classroom tasks, the format can be easily adapted to fit into a week's worth of instruction. Similarly, the time component can be fitted or augmented in such a way that the problem solving portion is longer or shorter than the project portion. Typically, projects take longer to construct, but given that much of the initial research has already gone into the learning goals of the unit by the time that students arrive at the project portion, less time overall will be required at the conception stage.

Table 1 describes the stages of the process and the role of the teacher in each stage. The flow of instruction leads from left to right throughout the process. The teacher's role alters throughout the unit, from being direct in the opening stages of both PbBL and PBL, then shifting approach to guide inquiry and scaffold research methods. At the end of both blocks, the instructor is present to evaluate overall learning and performance. At the midway point, instructors use those evaluation methods to construct or aide in the construction of collaborative groups for the project portion. Stages two and five will likely be the longest parts of the process. It is in these sections where formative assessments, both self and teacher administered will occur. It is here that teachers gauge the success of the individual or the group and make appropriate adaptations as needed.

Table 1: Teacher Stages and Roles

	Problem-Based (Individual)			Project-Based (Collaborative)		
Stages	1	2	3	4	5	6
Problem Project Based Learning Stages	Driving question on involved topic and launcher activities. Explain the responsibility of student roles	Individual research guidance, scaffolding and formative assessment	Evaluation of solutions and appropriate reflection activities	Collaborative grouping based on individual solution parameters	Group guidance on project creation and formative assessment of collaborative performance	Evaluation of projects and appropriate reflection activities. Summative assessment of concepts.
Self-Regulated Learner Stages	Activate prior knowledge, give appropriate time and feedback for planning	Transition from instructor to guide.	Facilitate discussion on resources relevance and individual process	Address individual needs in grouping. Reiterate learner goals	Transition from instructor to guide.	Provide authentic context for project presentations

Table 2 defines the students' roles. The students' roles during the unit are cyclical in nature. They complete the tasks in Stages 1, 2, and 3 individually and then work in collaborative groups to complete stages 4, 5, and 6. Students begin with their prior knowledge on the topic, and, in accordance with the traits of both SRL and PBL, begin planning ahead to their vision of a solution and a final product. This vision is a crucial component in the process as it drives the student to plan ahead. During the second phase of the units, they must monitor their own progress through the research and plan how to address the problem initiated by the teacher. After the solution is presented and based on the feedback given by the teacher, the student can then make generalizations about how the project can be constructed. The fourth stage involves communication and negotiation skills, as the students in the collaborative groups may have competing visions about the final product, though the teacher's role in pairing or grouping the students should weed much of this out.

Table 2: Student Stages and Roles

	Problem-Based (Individual)			Project-Based (Collaborative)		
Stages	**1**	**2**	**3**	**4**	**5**	**6**
Problem Project Based Learning Stages	Activate prior knowledge, recognize requirements for learner goals	Individual research, discerning of data, self-assessment and problem solution planning	Problem solution presentation. Self-reflection and teacher discussion	Negotiation with group members for collaborative project.	Collaborative research, role-taking and project assembly	Presentation with group,
Self-Regulated Learner Stages	Motivation and vision of problem solution through forethought	Self-Monitoring, revision and reflection on findings	Self-Reflect on performance strategies and resources	Negotiation and collaborative group planning	Communicate with group effectively	Self and peer assessment

Below, is an example of how this process might work when put into practice. The driving question informs both the problem and project throughout the unit. In this particular unit, students are asked to redesign large sections of the school to support a much larger school population. Though this is, essentially, a math unit of study, the standard component is based largely around social studies. The initial driving question can and should be used in other contexts depending upon the skills targeted in the lesson itself. For instance, a similar unit of study could be used to plan for a zoo expansion, thus bringing in animal needs and biology into the mix. Similarly, this unit could accommodate a focus on urban development, wildlife management or population density. According to the literature, problem-based learning is typically focused on a singular subject while project-based is interdisciplinary (Savery, 1995). In the model that I've proposed, however, the problem-based component can draw on many disciplines. There can, indeed, be more than one driving question that initiates the process, but for the sake of this paper, we will concentrate on one at a time.

Table 3: Math and Measurement Example

	1	2	3	4	5	6
Driving Question: How does population affect the environment?	What adjustments would have to be made if the size of the student body were to double in size?	Students research the demographics of the school. They look at classroom size and population density. They measure the capacities of the lunch room, play area, gymnasium, etc.	Students use graphs and other visual media to present their conclusions based on research. They then propose a possible solution given the space used in the school.	Collaborative groups are made based on student solutions (e.g. a group of students that agree classroom expansion is the most reasonable course is grouped to design and present the plan)	Collaborative groups plan a project to reflect their solutions. This could be a 3D graphical representation of expanded classrooms or a 2D computer graphical representation	Groups present their projects using either a live presentation or recorded video.

Template for Unit Structure

Below is a template for structuring the proposed unit design. This example is drawn from a basic, inquiry-based learning template that can easily be added to or amended (Wiggins & McTighe, 1998). In each box is a description of the contents that I would suggest for the unit. An exemplar of the aforementioned unit on measurement is included.

Table 4: Unit Template

<table>
<tr><td colspan="2">Standards</td></tr>
<tr><td colspan="2">Content Standards</td></tr>
<tr><td colspan="2">Driving Question</td></tr>
<tr><td colspan="2">The question that will drive instruction throughout the unit</td></tr>
<tr><td colspan="2">Prompt for Task</td></tr>
<tr><td colspan="2">Students are given a role to anchor their performance and a situation within which to work the problem</td></tr>
<tr><td>Problem-Based Performance (Individual)</td><td>Project-Based Performance (Group)</td></tr>
<tr><td>The personal research task to address the problem</td><td>The group task to engineer a solution</td></tr>
<tr><td>Problem-Based Assessments</td><td>Project-Based Assessments</td></tr>
<tr><td>Individual research guidance and solution evaluation</td><td>Collaborative group guidance and project evaluation</td></tr>
<tr><td colspan="2">Self-Regulation Checklist</td></tr>
<tr><td colspan="2">SRL Skills to be used during the process</td></tr>
</table>

Table 5: Unit Exemplar

<table>
<tr><td colspan="2">Standards</td></tr>
<tr><td colspan="2">Standard 3: (Geography) Students will understand the interactions and relationship between humans and their physical environment.</td></tr>
<tr><td colspan="2">Driving Question</td></tr>
<tr><td colspan="2">How does population affect the environment?</td></tr>
<tr><td colspan="2">Prompt for Task</td></tr>
<tr><td colspan="2">One of the schools in the city had to shut down due to a problem with finance. As a result, our school is expected to see a large influx of students over the next few years. Given your knowledge of the school and its grounds, our class has been asked to propose a solution and design a plan to accommodate all of the new students.</td></tr>
<tr><td>Problem-Based Performance (Individual)</td><td>Project-Based Performance (Group)</td></tr>
<tr><td>Students research the demographics of the school and measure the capacities of various rooms in it. Each proposes their findings and possible solution to the problem.</td><td>Student groups use their research to create a 2 or 3 dimensional design for school expansion using their measurements.</td></tr>
<tr><td>Problem-Based Assessments</td><td>Project-Based Assessments</td></tr>
<tr><td>Need-to-know display with written prompt
Google Forms survey for comprehension check
Individual presentations to class</td><td>KWL Chart for engineering task
Chart paper planning check
Group recorded presentation</td></tr>
<tr><td colspan="2">Self-Regulation Checklist</td></tr>
<tr><td>✓ Teamwork
✓ Self-Evaluation
✓ Negotiation
✓ Time Management</td><td>✓ Help-Seeking
✓ Organization
✓ Motivation
✓ Interest</td></tr>
</table>

The Driving Question

The driving question at the beginning of the unit must initiate and sustain discussion over the course of both processes (Mergendoller et al., 2006). Creating an appropriate driving question for the units requires time, planning and an effective understanding of the learner goals and content standards. In the specific case of the teaching style that I am proposing in this paper, the driving question must also be a solid initiator for both the problem and project side of this instruction.

To make an appropriate driving question, there are a few things that must be considered. First, is the question open-ended? An open-ended question has one specific answer that is correct, and there is no cause to debate the subject. Second, the question must be objective. Teachers can, of course, have opinions, but the purpose of this style of teaching is to have students reach their own opinions by doing research. If students are simply given the teacher's opinions at the beginning of the unit, the research that follows will have been formed based on an innate bias. This is not only a poor form of instruction but is also ethically unsound.

The question must require research. If the students can form a reasonable and presentable solution without doing any research, the question may not have been age-appropriate. On the other side of that, the question must be answerable by the age group with which you are working. If students fail to find or understand the solution to the driving question, even after exhaustive and scaffolded research, the question may not have been age-appropriate. A driving question must drive the project. They must not be too narrow so as limit the scope and possibilities of the research and not so broad that students find it difficult to navigate a path through the overabundance of information (English & Kitsantas, 2013).

This model is interdisciplinary in nature, and thus requires a question that incorporates multiple perspectives. In the above example, the driving question "How does population affect the environment?" is taken from the social studies American Education Reaches Out (AERO) standards. This standard, however, can be used to address multiple curricular dimensions. This is not to say that singular subject driving questions can never be used to create effective units. They are simply not appropriate to be used in this model.

Finally, the driving question must focus on the learner goals. This can be tricky, as creating a unit can inspire all manner of creative impulses in the teacher, and many interesting activities exist out there for students to do. It is important here, however, to ensure that processes are linked directly to these goals (Mergendoller et al., 2006).

Table 6: Driving Question Criteria

Criteria	Non-Example (N/E)	Problem with N/E	Example	Meets criteria
Open-ended	Where is Nicaragua?	Has a straightforward answer that is either right or wrong.	How does a country's location in world influence the culture of its people?	
Objective	Why is America the greatest country in the world?	Offers the opinion of the teacher and leads the students in a subjective manner.	Why do governments compare countries?	
Requires investigation	How many feet do you have	Easily answerable and not age-appropriate	How could you adapt to life without your feet?	
Answerable	Which religion is best?	Implies an objective answer to a subjective question.	How does religion impact the relationship between cultures?	
Interdisciplinary	How can we un-square numbers?	Specific to a subject and, while appropriate for a lesson, does not work with this format.	How can capacity affect relationships between individuals?	
Drives the project	How did Columbus first sail to the Americas?	Too narrow a topic with a straightforward answer	What was Columbus' impact on exploration to the Americas?	

Formative Assessment in Unit Planning

Formative assessment plays a crucial role in all forms of instruction. In this template, the role of formative assessment is to gauge student understanding before and during the unit processes, and to adapt the structure of the unit for students as the need arises. These types of assessment mainly take place in stages two and five of the unit structure as outlined above, but there are other areas where they can be implemented. The means of assessing are numerous, and I do not intend to supply an exhaustive list, but certain formative assessment practices will form a good roadmap for both students and teachers as they go through these units of studies.

While engineering assessments for the unit, the teacher should consider the driving question (Mergendoller et al., 2006). As stated above, the driving question should remain relevant for the entire unit, and formative assessments should always look back to the original question. In fact, one of the easiest forms for testing student understanding could be to simply ask how a given unit lesson refers back to the original question. Not only is this a simple tool to ensure that students continue to see the relevance of the driving question, but it can also give a good measure to the teacher as to whether or not the lesson was effective in driving the unit forward. Table 7 lists examples of formative assessment that can be useful in this style of unit planning with a brief description of how and when to use them.

Whichever formative assessment is used, the process should be cyclical. Teachers must illicit a response about student opinion or preconception. The students then respond with their current outlooks. The teacher checks their responses and provides descriptive feedback to help them further their learning. Based on that feedback, teachers then plan for additional scaffolding if needed, and students take some form of action to address their problems and questions. (Sadler, 1989)

Table 7: Formative Assessment Chart

Mind Maps	Highly effective for visualizing the learning. Students can create these starting from the single main idea and expand upon these as they progress through the unit. These should be used during stage one of the unit and be added to throughout
KWL Charts	Very adaptable and useful in learning visualization. The "K" (Know) column shows the students prior knowledge. The "W" (Want to know) column shows the path they can take with their research. The "L" (Learn) column should be added to as the progress through the research. Introduce at the beginning of the unit.
Need-to-Know	Another visual display that can be checked at the end of every unit and added to by the entire class. This is a simple list that students can add to while researching. When coupled with a quick thumbs down or thumbs up check, this can be a quick way to ascertain the effectiveness of the lesson. These can be used throughout both processes.
Writing Prompts	These help students reflect on the lesson and how it relates to the original driving question. They are very adaptable to the necessary situation and can have creative or problem-solving elements to them. Prompts can also be used to check conceptions throughout the learning process to see if their initial design ideas have changed during their research.
Journals	Students can write in their journals on a daily basis to reflect upon their progress throughout the entire process. A running journal can be highly effective for both students and teachers to see how the learning progresses from beginning to end.

Groupings for PBL Component

In stage four of the unit structure, teachers must facilitate grouping of students based on their solutions to the problem-based portion of the unit. This can be done in a variety of ways. The teacher could simply select the student groups, the students could form groups of their own, or an accommodation somewhere between these two can be made to both involve students and ensure that they are grouped in a way that befits the learning outcomes.

In the case of the sample unit discussed above, a simple sorting chart like Table 8 below can be used to create collaborative groups for their perspective projects. These possibilities were created by me for the purpose of this example, but there may be many more solutions that students envision.

Table 8: Grouping Chart Example

Solution #1: Expand School Grounds	Solution #2: Augment Current School Design	Solution #3: Construct New Building Adjacent to Current
1. 2. 3.	1. 2. 3.	1. 2. 3.

During this phase of the project, it is important for the teacher to reiterate the learning goals and the group expectations. It is expected for students in collaborative groups to be much more socially interactive, but this interaction cannot come at the cost of effective learning time. Teachers should consistently reinforce rules and procedures that ensure students communicate respectfully. This can be accomplished through a verbal contract with language the students agree upon beforehand or through a teacher-made written version that highlights responsibilities and expectations for group work.

Group roles can also be an effective tool to ensure student involvement. Coupled with the initial prompt for the task enlisting students in a role for the project, a group-specific role helps students to understand their responsibility in helping the group succeed. One such example could be that of the group leader who directs the members' conversation and ensures that each student is represented. Another may be the recorder, who takes down information during the group's meetings and collates the information. Having students take group roles puts the emphasis on the individual to meet expectations and gives them the opportunity to work with their strengths.

Authentic Assessments

This final section addresses setting the assessment and evaluating performance. It is important to begin the unit planning with assessments in mind. These will always reflect upon the driving question and, as with formative assessment, initiate a recall to that first premise. Authenticity, in the case of PBL and PbBL, is all about taking a set of skills and scenarios that exist in the real world and mimicking them in the classroom environment (Kracjik & Blumenfeld, 2006). In order for an assessment to be authentic, it must service the following criteria:

Table 9: Authentic Assessment Criteria

Authentic Assessment Criteria	Examples (Students will...)
Focuses on an aspect of the students' lives	Study the possible effects of global warming on their community
Meet a real need beyond the classroom	Create a website for books they've read at their grade level for younger students
Task prompt should reflect a realistic scenario	Propose a solution to deal with stray dogs in their city
Involve tools and/ processes that reflect how professionals operate	Conduct an online survey to determine grade level demographics

Authenticity in PBL and PbBL unit design is crucial to student motivation and interest. Designing worthwhile learning goals, goals that represent real-world scenarios, will help prompt students into respecting material and further delving into their own learning. Table 10 presents a unit rubric for this style of unit design. It covers all three of the processes and can be used as a means of assessing potential effectiveness of the unit in the style I have described above.

Table 10: Teacher Rubric

Elements of Unit	Missing one or more necessary features	Requires some improvement	Fully meets design principals
Content	Unit is not based around concepts and or the subject area(s).	Unit is based around some key concepts from the subject area but may include too few or too many.	The unit is based around and key concepts. The structure of the unit emphasizes the skills necessary to meet the goals in the subject area.
Self-Regulated Learning Component	SRL components are not included and/or not scaffolded in properly. Students are not required to think critically about their knowledge going into the unit and/or not asked to reflect about their performance over the course of the unit.	There is appropriate scaffolding to a certain extent, but the target SRL skills may be too many or too few. The collaborative component is more cooperative. Individuals may work together, but the final product is in pieces created by individuals.	An appropriate number of these skills are realized, actioned and assessed throughout the unit including self-reflection and forethought Unit has a collaborative component requiring communication and negotiation among stakeholders in or beyond the classroom
Driving Question	Driving question is not open-ended and lacking most if not all of the criteria as listed above.	Driving question may meet some of the criteria but not all. The question may not be focused on specific learner goals.	Driving question is open-ended, understandable and focuses on the intended knowledge students will be expected to understand by unit's end.
Inquiry	Inquiry is nonexistent. The unit is designed as a superficial project.	Inquiry requires some information gathering but not much more. Students may collect data, but they are not engaged with it in any meaningful way.	Inquiry is academically rigorous: students research, gather and interpret data to answer their own questions and create reasoned solutions.
Authenticity in Design	The process is wholly inauthentic: it does not reflect real-life processes or meet a need beyond its simulation.	The unit design may meet one or more of the necessary criterion, but does fully encompass the real-life	Both problem and project reflect a real need that exists in society. Students engage in actual practices with real

		processes for this design.	tools used by professionals in the field they are studying.

Due to the cyclical nature of this type of planning, students are given ample opportunity for scaffolded instruction and self-reflection. Through these methods, the tenets of SRL can be implemented and refined. The degree to which students will be able to self-regulate will be highly dependent upon the nature of the classroom before implementation (English & Kitsantas, 2013). Students may be initially hesitant to take on the responsibility, but through practice and careful implementation of the above design, classroom culture can quickly grow to fit the nature of this form of inquiry.

As stated above, units may have varying lengths depending on the type of learning objectives. As such, it is best to implement this unit structure with a singular objective in mind. Designing, monitoring and assessing using this unit can be time-consuming; there are a number of considerations that must be taken into account beforehand. Once the initial stages are underway, however, the teacher will have much less to do in terms of planning and set up. As the teacher role transitions from instructor to guide, the students can then take more initiative in guiding their own path. As they practice this further, student drive will ease the responsibilities of the teacher, and they can begin to plan units with more learning objectives. This application is all about creating, driving and facilitating students' motivation and allowing them to succeed with higher degree of independence and confidence.

CHAPTER IV: DISCUSSION AND CONCLUSION

Summary

The purpose of the research was to explore and define three processes of learning: project-based, problem-based and self-regulated learning. I wanted to look for commonalities in the approaches that could be used to create a planning tool for structuring and facilitating a quality learning experience. Each of the three forms was researched independently, yet much of the research showed an adherence to the same general principles of inquiry, research, teacher guidance and presentation.

Project-based learning emphasizes the creation of an artifact through which students showcased their learning. Each unit is based around a driving question that sets the stage for the unit and gives meaning to the series of activities to follow. These projects are collaborative in nature, interdisciplinary and require students to exercise their interpersonal skills (Krajcik & Brumenfeld, 2016). They end in an authentic venue for display and presentation.

Problem-based learning, in turn, focuses on creating a plausible solution to a complex issue. The issue would be messy and have more than one solution (Torp & Sage 2002). This type would also require a question to drive instruction. A problem or scenario would set the scene for the students, and they would have to work their way to an outcome. These types of units could be interdisciplinary in nature, or they could focus on one subject. The solutions were, similarly presented in a way that reflected the authentic nature of the task.

The research showed that self-regulated learning was a means by which students could take responsibility for their own knowledge and skill (Zimmerman & Martinez-Pons, 1990). Students set goals and expectations for themselves based around the needs of the unit of study. They put some forethought into requirements and develop a vision for the product or solution that they worked towards. They work with other students and evaluate their performance with improvement in mind.

Professional Application

The point of this tool is to use the functional tenets of these three learning approaches as a means by which teachers can create a thematic unit of inquiry that utilizes both problem solving and project creation. Self-regulation, on the part of the student, has been shown to be a necessary component of this process (Zimmmerman & Martinez-Pons, 1990). The aim of the application is to enhance PBL by adding a several dimensions to the process. Based on the work of Tilchin and Kittany (2016), each student from the class performs a personal problem-based study, and the results of this study are used to further their subject knowledge and, in student project-based groups, create the traditional PBL artifact.

Monitoring and assessing student performance are a utilized throughout the entire process, but the focus for teacher in these matters should be during stages two and five, when the students are left to independently or collaboratively explore, research and plan the results. The students, in this case, manage their own knowledge with the teacher acting as guide. Student independence is at the very heart of this style of instruction, because there are many variations and outcomes that can be reached with any given driving question.

With this conceptual framework, it is my hope that teachers can easily plan an inquiry unit using many different disciplines and styles of teaching. The example given in the application process is simply one way this could be instituted. In terms of implementation, this would likely be done with an experimental class where traditional curricular units could be augmented to this process. With proper observation and data collection, it could then be scaled, over time, to the entire school.

Limitations of the Research

The research on PBL, PbBL and SRL are far from limited. There is an extensive swath of research that covers all three processes spanning decades. The difficulty in this study fell to defining the terms in a way that would adhere to a consensus. Many of these terms have been used interchangeably, as discussed above, and seem to remain open to interpretation (English & Kitsantas, 2013).

Beyond definitions, many of the studies presented are advocacy papers for inquiry-based or constructivist-based approaches to teaching and learning (Zimmerman, 1990). Though authors often cited research (often their own), more prominent still were articles designed to push the process through a series of simple scenarios where the authors were positively disposed to the design.

Implications for Future Research

The framework is malleable and should be experimented with further. In order to develop this approach fully, it must be placed into practice, and student performance must be analyzed. It is one thing to create a good idea and another thing entirely to make it work. The implications for the process can be deduced by delineating each of the three processes and examining the result, but this may not be an accurate predictor of outcome. In the case of both project- and problem-based learning, the research is fairly consistent that motivation for task completion is an expected result (Tilchin & Kittany, 2016). Similarly, self-regulation can help propel this motivation and enable students to direct it independently. How the structure of the unit and its lessons will enrich this process will require much more study.

On the topic of motivation, higher-order thinking activities that mimic real-world ones have been linked to students motivation in schools (Blumenfeld, et al., 1991). This, however, is the result of the teacher creating a classroom environment that promotes this type of learning. Students may not be innately motivated to carry out PBL and PbBL learning activities that require higher-order thinking skills, especially when many schools' instructional models tend to favor a single-subject, direct instruction approach. Further research into the method by which classroom teachers can convert their classrooms into one that favors inquiry-driven learning processes would help them through this process.

Conclusion

The lessons students remember the most are often the ones that are the most complex. Day to day math worksheets and grammar drills may be effective in helping students recall the particulars needed in a larger context, but they are not unique nor are they impactful (Kracjik & Blumenfeld, 2006). The journey of discovery and the reward of accomplishment at the end of an in-depth task can give students an experience that they can look back upon and use throughout their academic and professional careers.

The unit planner I have designed above is a method through which teachers can plan such experiences. The curriculum content is not merely meant to be absorbed and repeated, it is meant to be explored and expanded. Beyond this, the students also explore inward; reflecting on their own attitudes towards instruction and motivational interests. It is involving and there is a lot of planning on the part of the teacher to ensure that students can accomplish what they are being challenged to do, but it is also flexible. Students may find a different pathway through the unit of study than originally planned.

A professor of mine once maintained that the substance of the curriculum wasn't as important as the process by which students explored it. We are in the business of helping students learning to think critically, to become involved citizens and to better the world in which we all inhabit. In order for this to happen, we must train our students to think; to think about themselves, their classrooms, the world at large and how it works.

The process described above is a simple one, one we use each and every day of adult lives. We find ourselves confronted with a problem, search for a way to solve it, come up with a solution and construct a way to fix it. Education must be applicable to the real world and cannot exist solely in abstraction. If it does, the why of what we are doing is lost and the how becomes little more than a chore to be done so we can get to recess.

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