Problem-based Learning Strategies that Contributed to Elementary Students’ Skills Development and Profile of a Virginia Graduate’s Expectations

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ABSTRACT

Key strategies of Problem-based learning (PBL) can contribute to students’ skills development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship (the 5 C’s). PBL is a popular trend in public education. It is generally defined as a teaching method in which students gain knowledge and skills by working collaboratively to investigate and respond to authentic and engaging open-ended questions and/or problems. This study explored the strategies teachers used when implementing PBL and what strategies aided in the skills development of the 5 C’s. The research question addressed was, What key strategies of PBL instruction contributed to the development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship for fourth and fifth grade students at one elementary school in Virginia? Through a basic qualitative study, information was gathered on the strategies used in PBL instruction in elementary classrooms to develop students’ 5 C’s. Findings suggest that small group work, student-centered learning, student choice, peer-to-peer relationships, and modeling were strategies used in PBL instruction to develop the 5 C’s. Participants were interviewed by a substitute researcher. Because of the researcher’s role as principal of the school in which this research is being conducted, anonymity was used to protect the employer/employee relationship and reduce researcher bias. Results were analyzed using a data analysis process to identify key strategies used in PBL instruction that increase the 5 C’s. Perceptions of the participants provided a better understanding of the strategies used during PBL implementation and skills development of the 5 C’s. Findings suggest that participants felt PBL
to be a successful instructional tool for elementary students. It increased engagement and increased skills development of the 5 C’s. The information gained should support leaders in the implementation of PBL in elementary classrooms.
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GENERAL AUDIENCE ABSTRACT

Key strategies of Problem-based learning (PBL) can contribute to students’ skills development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship (the 5 C’s). PBL is a popular trend in public education. It is generally defined as a teaching method in which students gain knowledge and skills by working collaboratively to investigate and respond to authentic and engaging open-ended questions and/or problems. This study explored the strategies teachers used when implementing PBL and what strategies aided in the skills development of the 5 C’s. The research question addressed was, What key strategies of PBL instruction contributed to the development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship for fourth and fifth grade students at one elementary school in Virginia? Through a basic qualitative study, information was gathered on the strategies used in PBL instruction in elementary classrooms to develop students’ 5 C’s. Findings suggest that small group work, student-centered learning, student choice, peer-to-peer relationships, and modeling were strategies used in PBL instruction to develop the 5 C’s.
Dedication

I dedicate this paper to my children, Blake and Grant. Do not let anyone tell you that you cannot do great things. Reach for your dreams. Hard work and dedication will allow you to be anything you want to be. I love you both very much!

I also dedicate this paper to my daddy, who always saw the best in me and pushed me to become even greater. His work ethic, strong sense of family, and dedication to his career were always an inspiration to me. Although I lost him unexpectedly during this doctoral journey, he is the reason I persevered and never gave up. Thank you, daddy, for always believing in me!

Finally, I dedicate this dissertation to my work family. To the students who have entrusted me as their teacher, to the teachers who have embraced me as their leader, and to my colleagues who support and guide me, I thank you! Without the daily hugs, many laughs, words of encouragement, and the feeling of family inside the school walls I would not have made it through this journey. This is by far the best career I could imagine. I look forward to the many opportunities that the future holds for us all!
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Chapter 1: Introduction to the Study

Overview of the Study

This study is a representation of the researcher’s effort to identify the strategies teachers used when implementing problem-based learning (PBL) in elementary classrooms at one school to support current and future administrators in making informed decisions on its implementation. The study was guided by the research question, What key strategies of PBL instruction contributed to the development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship (the 5 C’s) for fourth and fifth grade students at one elementary school in Virginia? As a student in the Educational Leadership and Policy Studies program through Virginia Tech, the principal of an elementary school with interest in PBL, and an educator with a passion for curriculum and instruction leadership, I think it is my responsibility to add to literature research-based strategies for implementing PBL into elementary instruction. It is my hope that the data analysis will provide teachers and administrators interested in implementing PBL into their own classrooms or schools with information on PBL strategies and how PBL strategies contributed to skills development of the 5 C’s.

Statement of Problem

A goal of public education is to ensure all students achieve at high levels through effective instructional delivery. This idea is based on many federal initiatives such as No Child Left Behind (2001) and the Every Child Succeeds Act (2015), as well as state initiatives, such as Virginia’s emphasis on performance-based assessment and the learning of the “5 C’s” – critical thinking, creativity, communication, collaboration, and citizenship. According to Koray, Presley, Koksal, and Ozdemir (2008), graduates with strong problem-solving abilities are life-long
learners who are able to critically analyze complex problems. PBL encompasses the 5 C’s as well as problem-solving opportunities by using models that focus on analysis, design, development, implementation, and evaluation (Chung & Chen, 2016). This is done through student collaboration and self-directed learning. A major part of PBL learning is collaboration (Drake & Long, 2009; Han, Capraro, & Capraro, 2016; Hmelo-Silver, 2004; Holm, 2011; Savery, 2006), which allows students to learn together by working through an authentic, real-world problem.

Even as long ago as the early 1960’s, renowned psychologist Jerome Bruner (1979) asserted that students need more time in the classroom discovering what is unknown rather than learning what is already known. Today, it is clear that policy makers, educators, politicians, and even corporate executives acknowledge the need for a change in the teachers to instill habits of learning in students.

**Significance of the Study**

It is clear that children need both knowledge and skills to succeed. According to the Buck Institute (2018), “this need is driven not only by workforce demands for high-performance employees who can plan, collaborate, and communicate, but also by the need to help all young people learn civic responsibility and master their new roles as global citizens” (p. 3). Furthermore, nearly all teachers understand how the industrial culture has shaped the organization and methods of schools in the 19th and 20th centuries, and they recognize that schools must now adapt to a new century. In a sense, the need for education to adapt to a changing world is the primary reason that PBL is increasingly popular. PBL is an attempt to create new instructional practices that reflect the environment in which children now live and
learn. PBL is one recent educational method that promotes problem-solving skills (Koray, Presley, Koksal, & Ozdemir, 2008).

With the emphasis on student-centered learning from the Virginia Department of Education (specifically the 5 C’s), this study focused on how strategies identified in PBL instruction have contributed to the development of the 5 C’s at the elementary level from the viewpoint of teachers and staff. It is the hope that the findings will add to the literature surrounding the use of PBL as a means for instruction in elementary school as well as support current and future leaders in the implementation of PBL in elementary classrooms.

**Purpose and Justification of the Study**

The purpose of this study was to identify key strategies teachers reported using during the implementation of problem-based learning (PBL) in fourth and fifth grade classrooms during the 2017-2018 and 2018-2019 school years. Furthermore, the study reports what strategies aided in the skills development of the Profile of a Virginia Graduate’s (VDOE, 2019) expectations of critical thinking, creativity, communication, collaboration, and citizenship. The context was on a targeted school that used PBL in grades four and five during the 2017-2018 and 2018-2019 school years. Through this study, the researcher identified key strategies used by teachers who implemented PBL at this school to determine if these strategies contributed to the development of the 5 C’s. The researcher analyzed interview transcripts in order to identify key strategies of PBL instruction through the lens of general classroom teachers, special education teachers, Title I teachers and aides who have worked in specific classrooms during a 2-year period. It is the desire of the researcher to add to the breadth of literature on PBL implementation strategies in elementary schools and add to the current literature on teacher perceptions of PBL in elementary schools.
Research Question

The research question was, What key strategies of PBL instruction contributed to the development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship for fourth and fifth grade students at one elementary school in Virginia?

Definitions of Terms

*Problem-Based Learning (PBL)*: a teaching method in which students gain knowledge and skills by working collaboratively to investigate and respond to authentic and engaging questions and problems (Marra, Jonassen, Palmer, & Luft, 2014).

*Student achievement* – academic growth and/or the improvement or achievement of the 5 C’s – critical thinking, creativity, communication, collaboration, citizenship (VDOE, 2019).

*Assessments* - Standardized assessments (benchmarks, Standards of Learning (SOL) data), group projects, performance-based assessments.

*Standards of Learning (SOL)*: a public-school standardized testing program in the Commonwealth of Virginia that sets forth learning and achievement expectations for core subjects for grades K-12 (VDOE, 2019)

*Traditional-Based Learning (TBL)*: a teaching method in which students receive instruction directly through the use of a textbook or other instructional material (Strobel & van Barneveld, 2009).

*PBL Instructional Strategies*: instructional approaches used in PBL to guide students through a problem and aid in students’ thinking

Limitations/Delimitations
This study was delimited to one school in southwest Virginia. It only took into account the viewpoints of elementary teachers and staff who worked in specific classrooms using PBL instruction during two academic years. It did not take into account the viewpoints of other teachers from the same school who did not work in classrooms using PBL instruction. Other teachers in the selected school may have used PBL instruction in their classrooms, but were not part of the project. They were not selected as participants because they did not use PBL as the main method of instruction and therefore could not provide information on strategies specific to PBL.

The researcher currently serves as principal at the school where the study was conducted. In order to reduce researcher bias, interviews were conducted by a substitute researcher who was briefed by the researcher on the topic, focus of the study, and interview protocol prior to conducting interviews. Having a substitute researcher conduct interviews allowed teachers and staff to give honest feedback without fear of consequences due to the relationship between the researcher and the participants. The researcher used the information collected to identify strategies used in PBL that contributed to the development of critical thinking, creativity, communication, collaboration, and citizenship in an elementary setting.

Another delimitation of this study was that the researcher only looked at PBL as an instructional method, not at other instructional methods that may be used in elementary classrooms. However, project-based learning (PjBL), case-based learning, and inquiry-based learning were researched to provide the researcher with a basis of understanding of other methods and their relationship to PBL instruction.

The decision to focus on PBL in this study was due to the emphasis from central office staff in the proposed site’s school division and the school’s teachers’ desire to try a new
instructional strategy. Selected participants of the study had taken the initiative to implement an instructional strategy new to many, specifically PBL, with encouragement from the former superintendent to try something different in their classrooms. The teachers chose PBL because three of the four had participated in The Virginia Initiative for Science Teaching and Achievement (VISTA) training, a PBL focused training in the summer of 2016. The researcher (principal) granted the teachers permission to use PBL in selected classrooms during the 2017-2018 and 2018-2019 school years.

The major limitation of this study was the researcher’s personal involvement as the school principal during data collection, which could have led to personal bias. The researcher limited personal bias through such efforts as using a researcher substitute to conduct interviews, anonymous participant responses, bracketing, and member checks (McMillian & Wergin, 2010, p. 91). The substitute researcher and guarantee of responses being anonymous was important so that participants could speak freely about their experiences and share honest opinions and viewpoints without fear of personal judgment or retaliation by the researcher (their principal). In the participant letter, the researcher explained the study and stated there would be no negative repercussions to the participant if identifying factors were to arise during the study. The researcher was not present during the actual interview, and responses were transcribed verbatim by GMR transcription services.

Member checks occurred in that transcribed interviews were shared with the participants “to ensure their perspectives have been recorded accurately” (McMilliam & Wergin, 2010, p. 92). The substitute researcher uploaded recorded interviews directly to GMR transcription services, received electronic transcriptions, and forwarded corresponding transcription to the corresponding interviewee who then verified the record by email response. Once verification
from the interviewee was received, the substitute researcher then shared transcribed interviews with the researcher for analysis. Seven consenting teachers who worked in grades four and five PBL classrooms during the 2017-2018 and 2018-2019 school years participated in the one-on-one interviews.

Organization of Study

Chapter 2 provides a review of relevant literature on PBL and student achievement. While this review is comprehensive, it is not exhaustive due to the vast amount of literature on the different elements of this topic. Chapter 3 outlines the methodology of the proposed study. Additionally, it addresses the data sources, participants, setting, and data analysis.
Chapter 2: Review of the Literature

The purpose of this literature review is to define problem-based learning (PBL), describe its history, and identify its instructional impact on student achievement to support the research question, what key strategies of PBL instruction contributed to the development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship for fourth and fifth grade students at one elementary school in Virginia? As the reviewer of research, I explored PBL and examined its impact on student achievement. Much of the research (Barrows & Tamblyn, 1980; Hmelo-Silver, 2004; Holm, 2011; Merritt, Lee, Rillero, & Kinach, 2017; Savery, 2006) concerns the history of PBL and on grades K-12 in general terms as well as post-secondary levels.

I reviewed literature relative to academic achievement and student impact. In order to better understand PBL, additional research was conducted on its history. My searches of PBL produced various definitions of PBL. PBL encompasses the key components of collaboration, learning by doing, open-ended problems or questions, and student-centered learning. For the purpose of this study, PBL is defined generally as a teaching method in which students gain knowledge and skills by working collaboratively to investigate and respond to authentic and engaging open-ended questions and/or problems. This definition generalizes what PBL encompasses within public school classrooms. Furthermore, this information supports the interchanging of key terms (notably PBL, problem-based learning, and project-based learning). This is further explained through this literature review and is all documented in my literature review table outlining sources reviewed on PBL (Appendix A).

I began my research of PBL with the question, what is PBL? Is there a positive academic impact on students who are exposed to the PBL method of instruction at the elementary level?
Why is research on PBL more focused on secondary and post-secondary learning? My interest surrounds elementary level public education in the United States. Through this literature review, research in the K-12 realm in the United States provided me with a framework for exploring the importance of PBL and its impact on student achievement. Research in the K-12 realm outside of the United States, as well as in secondary classrooms, provided me with context in which PBL is effective and findings that might have some applicability for K-12 elementary classrooms in the United States.

While PBL is not new, it has historically been utilized in the education of medical students. Its influence on student learning in other fields of education, specifically public education, has become more prevalent in recent years. Delise (1997) stated, “Educators who use problem-based learning recognize that in the world outside of school, adults build their knowledge and skills as they solve a real problem or answer an important question – not through abstract exercise” (p. 12). A recent push for graduates with 21st century skills has become the topic of discussion among businesses and educational agencies. The Virginia Department of Education introduced performance-based assessment and learning in 2016. New standards and revised assessments focus on 21st century skills – critical thinking, creativity, communication, collaboration, and citizenship – per the Board of Education’s Profile of a Virginia Graduate (2016). According to Koray, Presley, Koksal, and Ozdemir (2008) graduates with strong problem-solving abilities are life-long learners who are able to critically analyze complex problems. Because of the need for graduates to have these characteristics, I chose to review research on PBL and its impact on student achievement.

**Literature Search and Review Process**
To better understand how PBL affects academic achievement, with an interest specifically at the elementary level, a search for literature was conducted between October 2018 and February 2019 after I was trained by my committee chair Dr. Carol A. Mullen, with additional support from Virginia Tech Online and Graduate Engagement Librarian Lisa Becksford on how to conduct successful searches of literature. I primarily used the Virginia Tech online library database to find relevant sources of information, specifically EBSCO Host and Educators Reference Complete from Gale. Google Scholar and the Pro Quest database were also used to search for relevant sources. I only included peer reviewed and scholarly research articles that pertained to PBL in the search criteria.

The following key terms were used: problem-based learning, elementary school, and achievement. The initial search in EBSCO Host only contained the key term problem-based learning and produced 4,210 results while in Educators Reference Complete from Gale produced 2,288 results. The term elementary school was added, which narrowed the results to 209 in EBSCO Host and 408 in Gale. Finally, the key term achievement was added and further narrowed the results to 28 in EBSCO Host and 270 in Gale. Looking specifically at the results from the Gale database, articles that pertained to secondary education (college/university) were excluded. Articles, journals, and books from these narrowed results were previewed and key researchers were noted for further review. Additional searches included the terms project-based learning, PBL, K-12 education, and student achievement. Limited results were associated with student achievement in K-5 or elementary grade levels, so relevant results including K-12 and post-secondary education were reviewed. Results that included other countries and/or private schools were flagged for further review, but my focus is on public schools in the United States.
My interest in studying PBL lied at the elementary level, and research in the K-12 realm allowed me to provide a framework for the importance of PBL and its impact on student achievement. Articles, journals, and books from these narrowed results were previewed and key researchers were noted for further review. The literature review defined PBL, reviewed the history behind this method of learning, and studied the research on academic impact for student achievement.

Synthesis of Literature

This literature review explored PBL and examined its impact on elementary student achievement. However, much research focused on the history of PBL and focuses on grades K-12 in general terms as well as post-secondary. I reviewed literature relative to academic achievement and student impact; in order to better understand PBL, additional research was conducted on its history. My searches produced various definitions of PBL, which support the interchanging of key terms (notably PBL, problem-based learning, and project-based learning as documented on my literature review table; see Appendix A).

Table 1 contains sources reviewed on the topic of PBL most relevant to this study. I also used Table 1 to organize information retrieved for this literature search.

PBL Defined

While there is not a clear-cut definition of PBL, the terms problem-based learning and project-based learning are often used interchangeably. In public education, the initiative towards student-centered learning and focus on learning versus teaching is supported by the use of PBL. The Buck Institute for Education (2018) clarified that PBL is typically conducted in a small time frame (a class period) with a simpler problem whereas project-based learning (PjBL)
encompasses a longer period of time and often includes multiple tasks, disciplines, and responses. PjBL share commonalities with PBL. Grant (2011) supported

> Many of the principles of project-based learning are common to problem-based learning as well. However, while the emphasis in project-based learning may center on the production of a learning artifact, problem-based learning seems to require the acquisition of new knowledge. (p. 38)

Sutton and Knuth (2017) added that problem- and project-based learning differs in few details. Arguably, through PBL students learn essential content while solving a highly complex and ill-defined problem. However, the content which students learn depends on how they conceptualize the problem and potential solutions. PjBL emphasizes the product more than the process and teachers tend to emphasize predetermined content while giving students space and time to creatively apply that content to complete a relevant and authentic project (Sutton & Knuth, 2017, p. 66). For the purpose of this research, the terms PBL and PjBL will be distinguished, but commonalities between the two will be discussed interchangeably.

Most definitions of PBL focus on student-centered learning, real-world relevance, and collaboration (Barrows & Tamblyn, 1980; Hmelo-Silver, 2004; Marra, Jonassen, Palmer, & Luft, 2014; Savery, 2006). This overarching definition of PBL will be used for the purpose of this study. It encompasses what PBL is and how students should learn using this instructional practice. Students learning through PBL explore strategies to solve problems and apply content knowledge to real world problems. Students also collaborate to work through the given problems. Merritt, Mi Yeon, and Rillero, and Kinach (2017) stated that PBL fosters learning and the development of 21st century skills and competencies through problem solving, integration, and application of knowledge in real-world settings. This commonality of problem solving and
real-world application can be seen in many sources (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Chung & Chen, 2016; Hmelo-Silver, 2007; Miller, 2018) where PBL and PjBL are defined as methods of instruction in which students learn through problem solving. Thomas (2000) agreed that PjBL is a project that is central to the curriculum, focuses on the question or a problem, involves students, and is realistic. The Buck Institute for Education (2018) stated “project based learning prepares students for academic, personal, and career success, and readies young people to rise to the challenges of their lives and the world they will inherit” (p. 1). Therefore, students will carry the skills learned through PBL or PjBL instruction throughout their lives.

Another definition of PBL from Barrows (1986) is that PBL is an instructional method of hands-on, active learning centered on the investigation and resolution of messy, real-world problems. A central theme of student-centered learning through real-world problems is emerging. PBL is based on authentic problems and real-world need. Sutton and Knuth (2017) stated that, through PBL, students learn key content knowledge and cognitive, social-emotional, and democratic skills by solving authentic problems or completing projects that reflect a perceived need in the community. In PBL, students learn essential content while solving a highly complex and ill-defined problem. Similarly, PjBL, according to the Buck Institute for Education (2018), is a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging, and complex question, problem, or challenge. Skills learned through PBL instruction will aide students in real-life situations both in and out of the school setting.

PBL promotes student-centered learning with teachers as facilitators. This idea is supported by Savery (2006) who defined PBL as an instructional, student-centered approach that
encourages learners to research, integrate theory, and apply knowledge and skills in order to develop a solution to the defined problem. Colley (2008) agreed that PjBL is a student-centered teaching approach in which students produce outcomes by stating and answering research questions that are relevant to students’ lives. Also, Colley stated, “Students are encouraged to take responsibility for their own learning. They are provided with resources and guided and mentored throughout the learning process by a supportive teacher who holds them accountable at various points of the project” (p. 23). The teacher’s role as facilitator is different than the traditional approach of direct instruction, which is the method most teachers are accustomed to using for instruction. In PBL, teachers facilitate by asking what students already know, what they need to know, and where to find information relative to the given problem (Drake & Long, 2009). Hmelo-Silver (2004) described the teacher as a facilitator rather than a provider of knowledge. The teacher is able to model good strategies for thinking and learning and scaffolds student learning through modeling and coaching. The teacher moves students through the process and monitors group progress. Sage (1996) supported the idea that teachers need to model a skill, coach the skill, and then fade to allow groups to practice the skill on their own.

**History of PBL**

*PBL in the medical field.* The model for solving real-world problems began in the medical field and laid the foundation for future hands-on learning experiences across many fields of education. PBL was initially developed out of an instructional need of wanting to help medical school students learn basic science knowledge in a more lasting way while helping to develop clinical skills simultaneously (Marra & Jonassen, 2014). PBL was conceived and implemented in response to students’ unsatisfactory clinical performance (Barrows & Tamblyn, 1980; Chung & Chen, 2016) that resulted from an emphasis on memorization of fragmented knowledge from
traditional health education (Hung, Jonassen, & Liu, 2007. Merritt et al. (2017) supported that PBL originated in the medical field under the direction of Barrows. Howard Barrows was a physician of neurology and a medical educator who is widely known for his introduction of PBL. Barrows introduced the instructional method of learning by doing with his medical students and promoted student-centered, multidisciplinary education (Savery, 2006). Medical students’ clinical skills were assessed through the use of simulated patients and real-world scenarios.

In Problem-Based Learning: An Approach to Medical Education by Barrows and Tamblyn (1980) stated, “PBL is not simply the presentation of problems to students as a focus for learning or as an example of what has just been learned” (p. ix). PBL is a rigorous, structured approach to learning that is tailor-made for medical education and based on considerable experience and research. Barrows and Tamblyn explain how PBL can be used by students: allow students to analyze and develop problem-solving skills and facilitate appropriate self-directed study; as a result, students will have the opportunity to see PBL as an attractive, motivating format for learning.

The main objectives for introducing PBL to the medical field were to deliver knowledge in a clinical context, use clinical reasoning skills, use self-directed learning skills, and excite intrinsic motivation and inquiry (Yaqinuddin, 2013). Barrows and Tamblyn agreed, stating that the common factor is the need to actively apply knowledge to the assessment and care of patients and the ability to continue to identify areas of study. This would allow further learning to enhance or improve the practice of these skills. Neville (2009) explained that one of the most important differences between PBL curricula in the medical setting and traditional medical school curricula lies in the learning environment. This uses small group tutorials with a student-centered approach, active learning, the use of cases or problems, and a significant amount of time
for independent study. Thus, students learn with relatively little guidance where the main focus is on learning from one another and from the use of learning resources provided or identified by the students themselves. Barrows and Tamblyn (1980) defined PBL in medical learning as problem-based, student-centered learning that is the most efficient method of simultaneously developing knowledge, reasoning skills, and study skills.

**PBL and constructivism.** Learning by doing is a common trait to PBL and constructivism. Neville (2009) explained, “Such a minimally guided approach to learning, which is the essence of PBL, has been called by a variety of other names, including discovery learning, inquiry learning, experiential learning and constructivist learning” (p. 2). Constructivism is a learning theory that focuses on how people learn, process, interpret, and negotiate new information (Wilson, 2012). Savery (1995) termed constructivism as “a philosophical view on how we come to understand or know” (p. 31). Students who learn using PBL actively participate in the learning process. Educational constructivism impacts instruction and curriculum design because they are the most conducive to integration of current educational approaches (Jones & Brader-Araje, 2002). The constructivist theory focuses on the role of the individual, on the importance of meaning-making, and on the active role of the learner; consequently, this focus makes the constructivist theory appealing to educators (Jones & Brader-Araje, 2002). These traits of constructivist theory are also found in PBL.

The basis of PBL is learning by doing; therefore following the constructivist approach to learning the “hows” and “whys” behind things rather than simply focusing on rote memorization or fact recall. Miller (2018) supported PBL being a constructivist approach to education. In recent years, instructional design for the 21st-century learner has evolved from using previous
behavioral and cognitive theories into a more constructivist approach (Herndon, 2016). Learning how to apply skills to real-life situations is what PBL encourages and supports.

Students learn and develop critical thinking skills by solving real-world problems that follow the PBL model. This model follows the philosophy of constructivism, an educational philosophy that came to prominence in the early 1990s (Wilson, 2012). The basic precepts of the PBL model describe learning as an active process of meaning-making gained through experiences and interactions. Furthermore, the PBL model allows opportunities to arise as people encounter cognitive conflict and challenge during problem solving activities. PBL is a social activity involving collaboration, negotiation, and participation in authentic practices of communities. Learning, where possible, should include reflection and assessment, and feedback should be embedded naturally within learning activities (Drake & Long, 2009). Learners should take primary responsibility for their learning and own the process as far as possible. Wilson (2012) further explained that the PBL process reflects the nature of constructivist theorizing. Constructivist theory rests on a descriptive base but extends to guidelines for instructional design. The overall idea is for meaningful engagement and authentic practice of students with teachers as guides and students at the forefront of their own learning.

Students learning through PBL construct knowledge from the context in which it was acquired. Marra and Jonassen (2014) explained that “fundamentally, PBL is based on constructivist assumptions about learning” (p. 224) and knowledge learned can be demonstrated through expressing knowledge, meaning making, and learning. The ideas that we know and the skills that we have acquired consist mostly of the situation or context where they were acquired or have been applied. Making connections and applying learning to the real-world are main components of PBL in education.
Not all research supports PBL and its constructivist history. Kirschner, Sweller, and Clark (2006) defined constructivism as knowledge that is constructed by learners who are presented with goals and minimal information so that they form their own meaning and understanding. They also stated that learning is idiosyncratic; therefore, a common instructional format of strategies is ineffective. However, they argue that minimally guided instruction, such as PBL or constructivist-approached learning, is ineffective. They reported further that “the past half-century of empirical research on this issue has provided overwhelming and unambiguous evidence that minimal guidance during instruction is significantly less effective and efficient than guidance specifically designed to support the cognitive processing necessary for learning” (p. 76). For the purpose of this literature review, constructivism supported the PBL structure in regards to the educational setting studied.

**Other historical impacts on PBL.** John Dewey’s (1916) work focused on experiential learning (at times referred to as learning by doing). Project-based learning goes back to Dewey’s philosophy of learning by doing and hands-on learning approaches (Blumenfeld et al., 1991; Krajcik, Blumenfeld, Marx, & Soloway, 1994; Merritt et al., 2017). Dewey’s work led to a number of similar approaches referred to as PBL. Colley (2018) stated that Dewey and other progressive educators laid the curricular and psychological foundations for PBL. Drake and Long (2009) reported that scholars like Dewey have long advocated the PBL approach to promote students’ construction of knowledge through inquiry at the K-12 level. Dewey wrote that teachers should not be in the classroom simply as instructors but should be the facilitators of student learning (cited in Sahli, 2017). Sahli further supported that maturing students make connections between problems of interest to them, pursued simply for the sake of discovery. Students would then separate from their original interest to problem and work towards a solution,
regardless of their interest. By doing so, this would lessen the role of the teacher as the presenter of knowledge.

The PBL approach to learning was used prior to organized education, which included direct teaching of concepts and was found mostly in apprenticeship models. Sahli (2017) explained that in the earliest educational processes, whether the learner was working towards a profession or towards obtaining a skill, the instructional methodologies were informal and embedded within daily routine. As the need for a widespread and more academic educational system arose, schools were created. The learning model found in these early institutions followed a lecture-based model which relied heavily on the ability to access and read printed materials. Learning was reserved for the wealthy.

Hands-on learning was later adopted into education and focused on design principles that supported student learning. A group of researchers (Barron, Schwartz, Vye, Moore, Petrosino, Zech, & Bransford, 1998) described four design principles of PBL that support learning by doing. These principles include learning-appropriate goals, scaffolding that supports both the teacher and the student, frequent opportunities for formative self-assessment and correction, and social organizations that promote participation. Krajcik et al. (1994) stated that both teaching and learning are of primary importance in how learners attempt to make sense of what they are learning. To make sense of what you learn, you must do.

**PBL in the field of education.** This practice of hands-on, student-centered learning has expanded from the medical field into other fields of study (notably in education). Blumenfeld, Soloway, Marx, Krajcik, Guzdial, and Palincsar (1991) stated that PBL places students in realistic, contextualized problem-solving environments; problems or projects build bridges to connect the classroom to real-life experiences. This PBL curriculum, first used in the medical
field, implemented many of the characteristics that typify PBL today (Marra & Jonassen, 2014). PBL has notable characteristics in K-12 education as described by Savery (2006): the role of teacher as a facilitator of learning, responsibilities of the learners as self-directed and self-regulated, and essential components in the design of ill-structured or instructional problems as the driving force for inquiry. Utilizing these characteristics of PBL, a comparative study by Strobel and van Barneveld (2009) looked at how instruction using PBL versus traditional learning (whole-class, instructor-driven, lecture-based delivery of curriculum) affected retention of knowledge. They found that PBL was superior for long-term retention, skills development, and satisfaction; in contrast, traditional approaches were more effective for short-term retention.

**Instructional Practices.** There are other instructional practices that are used by practitioners in K-12 instruction. Many have similar components or general themes to PBL and are based on similar research studies (including Dewey). Larmer (2013), editor in chief of PBL Works, explains that many newer learning models (case-based, design-based, and problem-based) are basically modern versions of the same concept of project-based learning. All of these learning models fall under the general category of inquiry-based learning.

Inquiry-based learning is a student-centered, active learning process focused on questioning, critical thinking, and problem solving (Savery, 2006). The main difference in inquiry-based and PBL resides in the role of the teacher. Teachers are the facilitator of learning and provider of information in inquiry learning. Teachers are the supporter of the process who do not provide information to students in PBL. Jones and Eick (2007) stated that inquiry-based learning includes collaboration through co-teaching, planning, and troubleshooting to avoid problems and provide direction. Inquiry-based learning is student-centered and encourages the use of real-world problems to engage students in higher-order thinking.
Another type of learning that is often related to PBL and is based on Dewey’s work is case-based learning. Savery (2006) compared PBL learning to case-based learning and inquiry-based learning. Friesen and Scott (2013) explained that Dewey, a science teacher, encouraged K-12 teachers to use inquiry as the primary teaching strategy in science classrooms. Case-based learning helps learners understand important elements of a problem in a clinical setting. It also helps develop critical thinking by assessing information and identifying errors or false assumptions and is used to assess student learning after instruction (Savery, 2006). Both case-based learning and PBL promote active learning and engage students in higher-order thinking as seen in Table 2.

**Table 2. Differences between Case-Based Learning, Inquiry-Based Learning, and PBL**

<table>
<thead>
<tr>
<th></th>
<th>Case-Based Learning</th>
<th>Inquiry-Based Learning</th>
<th>Problem-Based Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method</strong></td>
<td>Guided inquiry</td>
<td>Leads to Open inquiry</td>
<td>Open inquiry</td>
</tr>
<tr>
<td><strong>Pre-reading material</strong></td>
<td>Provided</td>
<td>Provided</td>
<td>Not provided</td>
</tr>
<tr>
<td><strong>Teacher advance preparation</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Role of facilitator</strong></td>
<td>Active</td>
<td>Mixed</td>
<td>Passive</td>
</tr>
<tr>
<td></td>
<td>Uses guiding questions</td>
<td>Can provide problem, procedures, and materials to guide students through exploration</td>
<td>Don’t guide discussion even when learner explores tangents</td>
</tr>
<tr>
<td></td>
<td>Moderate loud learners Provide feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Role of Student</strong></td>
<td>Active</td>
<td>Active</td>
<td>Active</td>
</tr>
<tr>
<td><strong>Interaction with teacher</strong></td>
<td>Less</td>
<td>Moderate</td>
<td>More</td>
</tr>
<tr>
<td><strong>Skills learned</strong></td>
<td>Clinical</td>
<td>Problem solving</td>
<td>Problem solving</td>
</tr>
</tbody>
</table>

Inquiry-based learning is student-centered and encourages the use of real-world problems to engage students in higher-order thinking. This is also true of PjBL and PBL. Other than the framing and the more formalized steps in PBL, there is not much of a conceptual difference.
between it and PjBL. It is more a question of style and scope (Larmer, 2013). Figure 1 reviews the similarities and differences of project-based and problem-based learning.

The goals of PBL are to help students develop flexible knowledge, effective problem-solving skills, self-directed learning (SDL) skills, effective collaboration skills, and intrinsic motivation (Hmelo-Silver 2004). The goals of PBL as well as the instructional approach are similar to best practices currently being utilized in elementary classrooms in public schools.

![Project Based Learning vs. Problem Based Learning](image)

*Figure 1. Similarities and Differences between Project Based Learning vs Problem Based Learning. From Larmer, 2013.*
**Student Achievement**

**PBL in secondary classrooms.** Through research on how PBL or PjBL impacts student achievement, it was found that many classrooms utilizing PBL or PjBL follow a model (Blumenfeld et al., 1991; Grant, 2011; Harris et al., 2015; Horak & Galluzzo, 2017; Jones & Eick, 2007, Mergendoller, 2006; Summers & Dickinson, 2012). The model includes a driving question or problem and the production of one or more artifacts as representation of learning. Several sources (Chung & Chen, 2016; Drake & Long, 2009; Krajcik et al., 1994; Miller, 2018) indicated that PBL includes analysis, design, development, implementation, and evaluation of the problem in addition to following a design process. PBL engages students through an authentic question or problem. Students begin by identifying the question or problem and organize information. Then, students engage in investigations of the question or problem. Drake and Long (2009) explained that curriculum in a PBL model is organized around problems, not disciplines, with an emphasis on cognitive skills and knowledge. Blumenfeld et al. (1991) described using a model as a process that builds bridges between phenomena in the classroom and real-life experiences. Additionally, Hmelo-Silver (2007) explained that following a PBL model allows students to develop flexible knowledge, effective problem-solving skills, self-directed learning skills, effective collaboration skills, and intrinsic motivation. Many of these models were used in studies examining student achievement.

Through research, sources were found that reviewed the academic effect of PBL on student achievement. A majority of research found focused on secondary grades (specifically middle and high school math and science classes) (Geirer et al., 2008; Horak & Galluzzo, 2017; Jones & Eick, 2007; Krajcik et al, 1994; Mergendoller, 2006; Sage, 1996; Simons & Klein,
These studies describe how PBL affected student achievement at the middle and secondary level.

Geirer et al. (2008) compared student achievement in 7th and 8th grade classes receiving PBL instruction versus classes receiving traditional instruction using quasi-experimental methods. PBL was shown to be more effective in delivering content, and students performed better on high-stakes standardized tests in science. Similarly, in a study by Horak and Galluzzo (2017), academic and student perceptions of PBL instruction favored the PBL group. An indirect and constructivist approach to teaching can outperform a more direct approach to teaching. Students in this study found the PBL setting created a better learning environment compared to the traditional learning approach.

Summers and Dickinson (2012) saw similar results in their study of a high school social studies class. Students receiving PBL instruction had higher standardized tests scores and more positive learning outcomes compared to students receiving traditional instruction. Additionally, the PBL group had higher rates of promotion to the next grade. These findings all demonstrate the positive effects of PBL in secondary classrooms.

**PBL in elementary classrooms.** Research on the impact of PBL on student achievement at the elementary level has produced similar albeit fewer findings than in secondary classrooms. Sage (1996) reported that much has been written about PBL and its effects on learning at the post-secondary level (especially medical school) and that literature on PBL at the high school level is increasing. Hmelo-Silver (2004) explained that there has been little research that documents the relationship between PBL and academic achievement especially at the elementary and middle school levels.
Hmelo-Silver (2004) explained why little research has been found in K-12 classrooms using PBL. The main barriers include constraints of classroom organization and state-mandated assessments of students in specific subject areas. Also, it requires careful planning to engage students in the scheduled class period. Furthermore, there are a lack of qualified facilitators of PBL who can model good strategies for thinking and learning, including those who can scaffold student learning through modeling.

Although fewer studies have been found on PBL in the elementary setting, some studies of PBL and elementary achievement support the use of PBL (Barron et al, 1998; Drake & Long, 2009; Inel & Balim, 2010; Mitchell, Foulger, Wetzel, & Rathkey, 2008; Sage, 1996; Siew & Mapeala, 2017; Tillman, 2013). According to a quasi-experimental study by Inel and Balim (2010), the use of PBL in science and technology is more effective in enhancing students’ academic achievement than traditional instruction. Students rely on previous knowledge to identify a problem and resolve it. Students learn new information simply by participating in the learning and discussing of knowledge with peers. Koray et al. (2008) concluded that students participating in PBL performed significantly better on a problem-solving skills assessment than on receiving traditional instruction. Students receiving PBL instruction developed problem-solving skills, enhanced communication, and improved group working skills, as well as with the acquisition of knowledge.

In a pilot study of 4th grade science students by Drake and Long (2009), results indicated that PBL has promise in the elementary school classroom. There was significant growth in content knowledge of the PBL group compared to the control group receiving only traditional instruction. Students receiving PBL instruction demonstrated their strong ability to generate problem-solving strategies as opposed to their peers in the control group.
Arguably, Siew and Mapeala (2017) conducted a study with 5th grade science students on student motivation towards science learning. Their research showed that PBL is not sufficient in promoting motivation. As stated by Kain (2003), “Given that PBL has a record of success in sparking such curiosity and motivation, it is well worth considering as another tool to engage students” (p. 5). Drake and Long (2009) noted that the demands of high-stakes testing makes the teaching of science secondary to the teaching of math, reading, and writing. The focus on reading and math instruction at the elementary level often means that science instruction is not given as much instructional time and focus. Through the use of PBL, multi-disciplinary instruction becomes the primary focus of learning. Holm (2011) supported that using PBL fosters critical thinking and collaboration:

With renewed emphasis being placed on the basics of education, and increasing pressure to streamline instruction and teach to specific standards, the idea that the most effective instruction for these goals is also one that fosters depth of learning and engages students on a personal level is quite appealing. (p. 10)

Answering one question or problem can allow students the opportunity to use skills relevant to reading, math, science, and other areas of curriculum through the facilitation of the teacher.

In a study by Sage (1996), facilitators in first and second grade classroom found that their coaching skills, especially questioning strategies, were critically important in helping students bring out prior knowledge, distinguish fact from opinion, and push deeper for knowledge and ideas from students. Sage further explains a strategy for using PBL in elementary classrooms of “model/coach/fade” (p. 21). To facilitate effective small groups, the teacher may need to model a skill, coach group members on that skill, and fade teacher input to allow the groups to do it on
their own. This supports the notion that elementary aged students need to be taught how to think for themselves and build a strong foundation for inquiry.

**Profile of a Virginia Graduate’s 5 C’s**

The Profile of a Virginia Graduate is an initiative of the Virginia Department of Education (2019, VDOE) to meet requirements set forth by the 2016 General Assembly to identify the knowledge and skills that students should attain by the time they graduate in order to be successful. In developing the profile, the Board of Education determined that a life-ready graduate must achieve and apply content knowledge, demonstrate productive workplace skills, build community engagement and civic responsibility, and participate in career exploration. PBL is an instructional method that allows students to develop and build these skills. In order to achieve success, the development of critical thinking, creative thinking, collaboration, communication, and citizenship (5 C’s) should occur in a classroom and school environment. The VDOE (2019) has created the Virginia is for Learners website to provide educators with information on the 5 C’s. Information regarding the 5 C’s discussed in the next section has been taken from the Virginia is for Learners website, along with the Virginia Department of Education’s website.

**Critical Thinking.** One of the most valuable skills in life and learning is the ability to think critically. Students should be provided with opportunities to grow as critical thinkers (VDOE, 2019). Students need to identify issues and formulate questions for investigation. They should discover and appreciate multiple solutions and perspectives. Students need the opportunity to apply, analyze, interpret, evaluate, and synthesize information in a variety of ways. They need to reason and make inferences as well as reflect on their own thinking.
Allowing students to question and encouraging them to wonder will build critical thinking skills in a classroom and school.

**Creative Thinking.** In order to promote creativity in a classroom, students need the opportunity to take risks. Students all have different background knowledge then create questions, use resources and experiences to gather information, and develop new knowledge to share (VDOE, 2019). They should experiment and learn from their failures. Students should build on the past and embrace new ideas. Students need opportunities to recognize and utilize individual strengths to reach goals. Students should value the process of producing original work. Creative thinkers need to be pushed beyond surface-level understanding and promote their desire for exploration of content knowledge. Using their imagination confidently during tasks will produce success.

**Communication.** Communication is more than just speaking. One must be able to listen, articulate, evaluate, and respond to process learning (VDOE, 2019). Students need opportunities to engage in communication activities that develop these skills. During such opportunities, they need to actively listen. They should know and respect their audience. They should recognize and effectively use verbal and nonverbal cues. Utilizing all forms of communication will allow students to be successful and effectively communicate with others.

**Collaboration.** Working towards a common goal with others is a difficult task for children. Building this skill, learning to compromise, demonstrating flexibility, and sharing responsibility will enable students to gain the skill of collaboration (VDOE, 2019). Students should value and search for others’ opinions, perspectives, and abilities and use those to work towards a common goal. In order to grow and thrive in an ever-changing world, students need to
seek out connections, be able to plan, organize, and complete tasks, and be a valuable member of a team.

**Citizenship.** One of the best ways students can grow as a citizen is to experience quality examples of and engage in citizenship in action. Students need opportunities to demonstrate trustworthiness, respectfulness, fairness, responsibility, and caring (VDOE, 2019). Learning about the past, participating in the present, and caring about the future can produce strong citizens.

By preparing critical thinkers, embracing creative thinking, practicing communication skills, encouraging collaboration, and developing citizenship skills Virginia’s students are provided with experiences that prepare them for life beyond high school. Incorporating the 5 C’s into classrooms allows educators to promote well-rounded students. PBL is an instructional model that provides opportunities for these skills to develop.

**Summary**

The topic of this literature review is PBL and elementary student achievement. Student achievement not only refers to academic growth, but growth in the areas of critical thinking, creativity, communication, collaboration, and citizenship. Much of the research found looked at the effects of PBL in K-12 classrooms; however, middle and secondary classrooms tended to be the area of focus for such research. Novice learners, such as elementary students, need to learn how to utilize the strategies of PBL under the guidance of the teacher; hence, teachers transition to being the facilitators of learning. Students can become independent, motivated learners who are able to apply their skills to real-world problems through personal and group inquiry. This review of literature demonstrated some of the background of PBL and its evolution into public education and classrooms. It also supports the interchangeability of the terms problem-based
learning, project-based learning, and PBL for the purpose of learning by doing in the classroom setting. PBL is not new; however, the focus of its effectiveness in elementary classrooms is limited. Much of the research on elementary PBL focuses on students’ perceptions and attitudes towards PBL rather than its impact on academic achievement. This study should add to the literature base regarding the use of PBL instruction in elementary classrooms and strategies that contribute to the 5 C’s skills development.
Chapter 3: Methodology

Purpose of the Study

The purpose of this study was to identify key strategies teachers reported using during the implementation of problem-based learning (PBL) in fourth and fifth grade classrooms during the 2017-2018 and 2018-2019 school years. Furthermore, the study reported what strategies aided in the skills development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship (VDOE, 2019). Being able to work together to solve a problem, communicate ideas effectively, give and take feedback, and think outside of the box are all skills that students need in order to be successful in the classroom and in the workforce.

When I began my doctoral journey, I wanted to see if PBL instruction makes a difference in student achievement, specifically in student populations with the Profile of a Virginia graduate’s 5 C’s and end of year SOL scores. According to the Virginia Department of Education’s Profile of a Virginia Graduate, the 5 C’s are critical thinking, creativity, communication, collaboration, and citizenship. After doing initial research, I was less interested in the SOL data and more in teachers’ perspectives of improvement of the 5 C’s.

With a focus on curriculum and instructional leadership, this study added to the literature surrounding the impact of PBL instructional strategies on students use of the 5 C’s. It is my hope that the results of this research inform instructional leaders on the impact of PBL in the classroom and of the potential benefits. This study could add to the literature base regarding the use of PBL instruction in elementary classrooms and strategies that contribute to the 5 C’s skills development.
Results from this study should provide scholars with additional research to support the use of PBL in classrooms and elementary leaders working with schools and divisions. Specifically, key strategies used in PBL implementation are expected to be identified, and alignment with the 5 C’s in instruction will be studied.

Research Design

A basic qualitative study methodology was used to investigate the research question; what key strategies of PBL instruction contributed to the development of The Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship for fourth and fifth grade students at one elementary school in Virginia?

The study was conducted at an elementary school in a rural school district in southwest Virginia where the researcher serves as principal and has been since 2015. Teachers at the selected school (under the challenge of their former superintendent) wanted to provide an untraditional learning opportunity where students learn in a way that was unique to elementary classrooms. Teachers wanted to compartmentalize within the school, reorganize the traditional structure of grades four and five, and work in two distinct cross grade-level teams. One team focused on PBL instruction while the other used a more traditional approach to instruction. With permission from the superintendent and the principal in March 2017, teachers began to carry out the plan of reorganizing fourth and fifth grade classrooms into two distinct teams: one team of four classroom teachers was designated as the PBL team while another team of four classroom teachers was designated at the TBL (traditional-based learning) team. Through this study, the researcher identified key strategies used in effective PBL instruction and identified the relationship between key strategies of PBL instruction and improvement in the 5 C’s.
According to Miles, Huberman, and Saldana (2014), qualitative research samples tend to be purposive rather than random. Therefore, the eight general education, special education, and Title I teachers and aides who used and/or PBL as an instructional method were invited to participate in this study.

Each participant participated in a single one-on-one interview with a substitute researcher due to the researcher’s supervisory role at the selected school. All interviews were conducted by a graduate student of the researcher’s advisor at the selected school. Interview protocol was followed as described further in the Data Collection section. Interviews were digitally recorded and transcribed using the GMR transcription service, an online transcription service approved during the IRB process. Transcripts were provided to the participants to verify their record of responses.

The researcher used transcripts to code interviews in order to determine key strategies used in PBL instruction. Codes are labels that assign symbolic meaning to the descriptive or inferential information compiled during a study (Miles, Huberman, & Saldana, 2014). Key points the researcher used for coding include strategies of PBL and the 5 C’s. According to Creswell (2015), coding is the process of analyzing qualitative text data by taking them apart to see what they yield before putting the data back together in a meaningful way. The researcher made notes while reading transcribed interviews to look for themes and over-arching key points. Notes were then organized into a data summary form using Microsoft Excel. Column headings included key points from each research question, and rows signified individual participant interviews. In order to achieve reliability in coding, the substitute researcher reviewed a sample data set and coded in the same manner as the researcher. This method of intercoder reliability ensured that the coding of the content is valid (Miles, Huberman, & Saldana, 2014). Data collected from the qualitative
study were used to determine the strategies used by teachers during PBL instruction in elementary classrooms and their contribution to the development of critical thinking, creativity, communication, collaboration, and citizenship.

**Research Design Justification**

The methodology used for this study on the topic of PBL strategies and skills development of the 5 C’s should add to the literature surrounding the use of PBL as a means for instruction in elementary school as well as support current and future leaders in the implementation of PBL in elementary classrooms. A basic qualitative methodology was utilized to identify key strategies used during implementation of PBL based on teacher reports at one elementary school in southwest Virginia. The practical outcomes anticipated were to identify key strategies used when implementing PBL in elementary schools in order for educational leaders to make informed decisions on the use of PBL instruction in elementary classrooms. Another outcome of the study was to identify connections of PBL instructional strategies to student development of skills in critical thinking, creativity, communication, collaboration, and citizenship.

**Research Question**

What key strategies of PBL instruction contributed to the development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship in fourth and fifth grade students at one elementary school in Virginia?

**Study Setting**

The selected school was an elementary school located in Southwest Virginia, that, under encouragement from division leaders, implemented a PBL program supporting the Profile of a Virginia Graduate’s 2015 initiative from the Virginia Department of Education. This
implementation was done in four classrooms of grades four and five during the 2017-2018 and 2018-2019 school years.

**Selection of the Participants**

Selected staff working in a single elementary school who participated in a PBL program were targeted for participation in this study. Accordingly, Creswell and Poth (2018) explained that criterion sampling involves selecting cases that meet some predetermined criterion of importance. Criteria for participating teachers include general education teachers, special education teachers, and Title I teachers and aides who worked in the identified fourth and fifth grade classrooms during the 2017-2018 and 2018-2019 school years. Eight staff met this criteria and were invited to participate once approval had been granted.

The researcher scheduled a meeting with the division superintendent to request permission to conduct the study and interview participants. A follow-up letter was sent to the superintendent to request permission to conduct the study. After the researcher obtained written approval from the division superintendent, a letter was emailed to the eight identified potential participants explaining the study and requesting participation. Once participants agreed to participate, interview dates and times were scheduled.

**Data Collection Procedures**

Data collection for this study occurred through a single one-on-one interview with a substitute researcher. Each interview lasted no longer than 45 minutes, followed interview protocol, and was digitally recorded. The substitute researcher uploaded recorded interviews directly to GMR transcription services, received electronic transcriptions, and forwarded each transcription to the corresponding interviewee who then verified the record by email response. Once verification from the interviewee was received, the substitute researcher then shared
transcribed interviews with the researcher for analysis. The researcher then reviewed each transcribed interview, making notes during analysis looking for common themes and trends. Coded themes and notes were entered into a Microsoft Excel sheet to organize data collected. Specific analysis procedures are discussed in the Data Analysis section. Prior to beginning the study, the steps for obtaining permission for the study were discussed.

**Study Approval Process and Timeline**

1. The researcher has completed the Virginia Tech Institutional Review Board (IRB) training through coursework prior to conducting the study. CITI training on Social and Behavioral Research has been completed (February 2019). A copy of the certificate is in Appendix B.

2. The researcher completed an IRB Research Protocol and obtained permission to conduct the study from the Virginia Tech Institutional Review Board following approval of the prospectus defense (see Appendix F).

3. A meeting was held with the division superintendent to request permission to conduct the study at the selected school upon successful completion of the prospectus defense. A follow-up letter was submitted to the division superintendent. The letter described the purpose of the study and explained the data collection process (see Appendix C).

4. A letter was sent to selected participants explaining the study and requesting participation (see Appendix D).

**Instrument Design and Validation**

Validity, according to Creswell and Poth (2018), is one of the strengths of qualitative research. Creswell also explained that qualitative validity means that the researcher has checked for the accuracy of findings by employing certain procedures. In order to create an acceptable
interview protocol, one must determine the questions to which interviewees will respond. Interview protocols, as suggested by Creswell and Poth, followed these procedures:

- Determine the research questions that will be answered by the interviews.
- Identify interviewees who can best address these questions based on a purposeful sampling procedure.
- Distinguish the type of interview by determining what mode is practical and what interactions will net the most useful information to address research questions.
- Collect data using adequate recording procedures when conducting one-on-one or focus group interviews.
- Design and use an interview protocol or interview guide.
- Refine the interview questions and the procedures through pilot testing.
- Locate a distraction-free place for conducting the interview.
- Obtain consent from the interviewee to participate in the study by completing a consent form approved by the human relations review board.
- Follow appropriate interview procedures.
- Decide transcription logistics ahead of time. (p. 165)

Qualitative interviews allow the researcher to understand participants’ experiences and reconstruct past events. In order to refine the interview questions and procedures, pilot testing was completed with the substitute researcher. According to Rubin and Rubin (2005), open-ended interview questions allow for deeper understanding into the participants’ experiences and perspectives of the PBL instructional delivery method. The interview questions outlined allow for open-ended responses, giving participants opportunities to express their views and experiences.
1. How would you describe PBL instruction that was used in your classroom?

2. What strategies used in your PBL instruction do you think are important?

3. How have strategies you’ve used helped students develop the following skills?
   a. Critical Thinking
   b. Creativity
   c. Communication
   d. Collaboration
   e. Citizenship

4. Are there specific strategies that contributed to stronger development of any of these skills? Explain.
   a. Critical Thinking
   b. Creativity
   c. Communication
   d. Collaboration
   e. Citizenship

5. Based on your teaching experiences, what are some strengths of using PBL in elementary classrooms?

6. Based on your teaching experiences, what are some concerns or challenges with implementing PBL?

7. Based on your experiences with PBL, have you continued using PBL in your classroom? Why or why not?

8. Is there anything else you would like to add?
In addition to pilot testing the interview questions and procedures to refine the process, Table 3 was created to ensure alignment between the interview questions and the research question.

Table 3. *Alignment of Research Question, Data Sources, and Analyses Procedures*

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Data Sources</th>
<th>Data Analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ: What key strategies of Problem Based Learning instruction contributed to the development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship for fourth and fifth grade students at one elementary school in Virginia?</td>
<td>Qualitative Interviews Viewpoint of Teachers/Staff</td>
<td>Deductive Coding Code responses by strategies identified and 5 C’s Read transcribed interviews and note codes in Margins Create labels in Excel document to organize information from interview questions</td>
</tr>
<tr>
<td>Sub Questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategies of PBL</td>
<td>Interview Question 2 and others</td>
<td>Code: Strategy Teachers identify strategies of PBL used during implementation Look for common strategies used</td>
</tr>
<tr>
<td>Development of Skills</td>
<td>Interview Questions 3, 4, and others</td>
<td>Code: 5 C’s Teachers identify skills developed through PBL instruction – note commonalities Teachers identify which strategies impacted which skill – note commonalities</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>Interview Question 3a, 4a</td>
<td>Code: CT</td>
</tr>
<tr>
<td>Creativity</td>
<td>Interview Question 3b, 4b</td>
<td>Code: CR</td>
</tr>
<tr>
<td>Communication</td>
<td>Interview Question 3c, 4c</td>
<td>Code: COM</td>
</tr>
<tr>
<td>Collaboration</td>
<td>Interview Question 3d, 4d</td>
<td>Code: COL</td>
</tr>
<tr>
<td>Citizenship</td>
<td>Interview Question 3e, 4e</td>
<td>Code: CZ</td>
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</table>

Interviews took place in a one-on-one format between a qualified research substitute and the interviewee at the proposed study site. Interviews lasted no longer than 45 minutes and took
place in one sitting. The substitute conducted the interviews in order to limit researcher bias since the researcher serves as some of the potential participants’ direct supervisor. Interviews were digitally recorded by the substitute and were submitted to be electronically transcribed. After transcriptions were verified by each interviewee, transcripts of the interviews were analyzed and coded. The researcher followed a data analysis process to analyze data. Coding was used to identify key strategies of PBL instruction. This process is explained further in the Data Analysis section.

**Data Treatment and Management**

All data collected were stored on the researcher’s laptop computer which is password protected and accessible only by the researcher. Transcripts of the interviews conducted by the research assistant were stored electronically. Data reviewed from state education agency (Virginia Department of Education) are public information and are stored on the state education’s website (www.doe.virginia.gov). School Quality Profiles provided public information on demographics and SOL scores and were reviewed for this study. The dissertation researcher, the substitute researcher, and my dissertation chair were the only individuals with access to data collected.

**Data Analysis**

Analyzing data identifies themes and explain relationships among data. After researching various methods of qualitative data analysis, I utilized the following process to organize data, read transcribed interviews and make notes to help identify themes and key points, merge overarching themes into key points, and interpret data to make generalizations and summarizations. Figure 2 is an overview of this data analysis process.
Data analysis and representation for each participant followed the process outlined by Creswell and Poth (2018).

- Create and organize data files to manage and organize the data.
- Read through text, make margin notes, and form initial codes to read and memo emerging ideas.
- Describe the case and its context to describe and classify codes into themes.
- Use categorical aggregation to establish themes or patterns to develop and assess interpretations.
- Use direct interpretation and develop naturalistic generalizations of what was learned to represent and visualize the data. (p. 199)

In order to begin the data analysis process of the data collected, the researcher developed a data summary form using Microsoft Excel to organize transcribed interview responses. The data summary form is a tool that helped the researcher organize and categorize the information collected. Each interview question was a column heading with each row being a participant. The researcher developed a list of codes to start with based upon the research question. Miles, Huberman, and Saldana (2014) describe this as deductive coding. The researcher coded...
transcribed interviews and transferred coded information into the data summary form to aid with organization of themes. Notes taken in margins while reading the transcribed interviews were coded by key points:

- Strategies used in PBL instruction.
- Identification of the 5 C’s
- Increase in skills development of the 5 C’s

Coding continued in the data summary form to aid with organization and analysis of data. Inductive coding (Miles, Huberman, & Saldana, 2014) could emerge during data collection and analysis. Focus of coding remained on the key points. The researcher looked for common strategies teachers report using during implementation. The researcher also noted commonalities of strategies identified by teachers impacting certain 5 C’s. Following this coding process allowed the researcher to make connections and synthesize the data to complete the within-case analysis in order to answer the research question.

**Summary**

Chapter 3 is an overview of the proposed research design and justification, proposed study site and participants, limitations, procedures for collecting, managing, and analyzing data, and a timeline for completion. By conducting this study, the researcher identified key strategies used by selected participants during PBL instruction based on participant report. Additionally, the researcher examined how reported PBL strategies used by selected participants contributed to the development of the 5 C’s. One-on-one interviews with each of the participants by a substitute researcher provided the researcher with teachers’ perceptions of PBL implementation. This data fostered researcher understanding of the strategies teachers used during PBL implementation that contributed to the development of the 5 C’s in grades four and five. The researcher also gained
information from data collected to support teachers and administrators interested in the implementation of PBL into elementary classrooms.
Chapter 4: Data Analysis

Introduction

The purpose of this study was to identify key strategies teachers reported using during the implementation of problem-based learning (PBL) in fourth and fifth grade classrooms during the 2017-2018 and 2018-2019 school years. Furthermore, the study also identified what strategies aided in the skills development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship. Three classroom teachers, two special education teachers, one Title I teacher, and one Title I aide participated in this study to answer the following research question: What key strategies of PBL instruction contributed to the development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship for fourth and fifth grade students at one elementary school in Virginia? The division superintendent gave approval for teachers to participate in this study conducted by the researcher, who also serves as building principal. Eight teachers were contacted to participate (seven agreed) equaling an 87.5% participation rate. Six of the seven participants were still working at the school where the study was conducted. The 7th participant was still in the same division, but was working at a different school.

Due to the researcher being the principal of six participants, a substitute researcher conducted interviews as discussed in Chapter 3. After the interviews were conducted, the substitute researcher sent participants’ responses to be individually transcribed using the GMR Transcription Service. Upon verification by the participant, transcribed interviews were sent by the substitute researcher to the researcher for analysis. All transcriptions were put into one Microsoft Excel document. In the Excel document, all responses were aligned for each question in a worksheet to help organize the data. Once all responses were organized by question, a
thorough analysis of the data was completed through deductive coding exercises. The substitute researcher and the researcher independently coded one question to ensure coder reliability before the researcher completed data analysis. Common themes and strategies used by the participants were developed. The present chapter displays the findings for each interview question.

Analysis of Interview Questions

Interview Question 1. How would you describe PBL instruction that was used in your classroom?

Each of the seven participants shared his or her personal experience using PBL instruction in their classroom. Common themes of hands-on learning (3 out of 7), student choice (5 out of 7), and collaboration (7 out of 7) emerged from responses while describing PBL instruction. Participant A noted students had choices, which “kids seem to really, really like” (A, l 22). Participant C described PBL as “A hands-on, critical thinking, integrated type of teaching and learning that kids loved” (C, l 14). Participant C discussed students working together and students learning teamwork. Another component noted by Participant C was the role of the teacher as a facilitator rather than “actually teaching in front of the class” (C, l 20) Participant D described PBL as a hands-on experience to give real-world application of the subject matter while Participant F used the phrases highly effective and very engaging for the students.

Participants A, B, and G focused on their role as support staff during PBL instruction. Participant A focused on reading content and the participant’s experience as a Reading Specialist. Examples shared include building scenery or characters, creating videos, presenting assignments to classmates, and various tasks students used to demonstrate knowledge. Participant B shared experiences from the viewpoint of a Special Education teacher. Participant B noted students struggled in the beginning with working together or wanting to “do their own
thing” (B, l 23), but with modeling and practice, students learned how to work with one another. Participant E stated PBL was used as a tool for instruction and discussed examples of cross-curricular assignments and buy-in from the kids that made PBL successful in the classroom. Participant G shared experiences through the role of a Special Education teacher and the benefits of hands-on learning for students. Participant G also discussed the integration of content into tasks and how it allowed students to work together.

Interview Question 2. What strategies used in your PBL instruction do you think are important?

Table 4 demonstrates the abbreviated responses of participants when discussing strategies used in PBL instruction. Responses relate to each participant’s individual experience with PBL and the participant’s role in instruction. Analysis of the data showed that, based on the participant’s role, importance of strategies varied. Two participants, special education teachers, focused on the strategy of individualized learning. Participant B stated monitoring each individual student’s progress was important. Similarly, Participant G noted allowing students to select the task or problem to study was beneficial because it gave them ownership and allowed them to express themselves in a meaningful way. Participant C also supported the idea of individualized learning. Participant C shared the idea of passion projects. Passion projects were student selected activities that allow students to explore their passions while encompassing PBL strategies and instructional skills. Participant C also shared the ability for students to self-select reading assignments that were of interest as opposed to entire classes reading the same book: “When they are excited about it and it’s something they want to learn and aren’t forced to read about, you’d be amazed by how much they read” (C, l 59). These examples demonstrate the
benefits of individualized learning as a PBL strategy based on responses of interviewed participants.

Table 4. *Interview Q2: Strategies used in PBL*

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<tbody>
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<tr>
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<tr>
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<td>X</td>
<td>X</td>
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<tr>
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<tr>
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<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
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<tr>
<td>Real-life application</td>
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<td>Self-discovery</td>
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<tr>
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</table>

Important strategies noted by participants include modeling, collaboration, and communication. Participant D explained that by introducing the subject, modeling it, and then letting students be creative to find solutions was a strategy that participants felt to be effective. Participant D noted there is more than one solution to a problem, and allowing students the freedom to explore and self-discover was an important teaching method. Participant G felt that students having the ability to openly express themselves not only improved their academics, but their open communication skills with peers, among their peers, and even among the teachers. Similarly, Participant C shared “I didn’t really tell them how to think” (C, l 50). By discussing students’ thinking and ways to solve a problem, students opened up and started working together to solve problems.
Interview Question 3a. *How have strategies you’ve used helped students develop Critical Thinking skills?*

Participant responses are summarized in Table 5. Participants shared similar ideas on strategies that helped students develop critical thinking skills, such as asking questions, using real-world problems, and student independence.

Table 5. *Interview Q3a: Strategies to Develop Critical Thinking*

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<tr>
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<td>Student Choice</td>
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More specifically, Participant A discussed asking questions as a strategy that helped students develop critical thinking skills. In summary, Participant A stated “students need to ask questions, think about what happened in the story, and pull all that together into a product that displays thinking” (A, l 52). Participant C explained that questioning students during the learning process caused them to think more critically, which helped build that skill.

Participants B and E had similar responses focusing on independent learning and self-learning. Participant B noted the teacher is not there pointing out specific things: this will make the kids think for themselves and make them more independent. Participant E concurred, sharing an example of an analogy that was shared with students:
I’m gonna throw you in the deep end. There are going to be moments where you feel like the water is rushing in but I promise you, you have a life preserver. You’re going to bounce up to the top. Oxygen is coming. It’s going to be okay. (E, l 130)

This analogy illustrates Participant E’s viewpoint on student-driven learning and building independent thinking.

Participant F had a similar response but focused more on student choice. Participant F stated, “I believe putting them in the driver seat then making it a topic of investigation or a problem in which they have a choice makes them more excited about researching and discovering what it is they like or don’t like” (F, l 67). Allowing students to have a voice in the type of assignment or problem they are to complete makes for a better learning situation and a more engaged student. This builds critical thinking skills.

Participants C and D noted a strategy aiding in the development of critical thinking was using real-world problems. Participant C asserted real-world problems allowed students to make connections. One example given was a problem they did focused around Shark Week: Sharks were coming to shore, what are we going to do about it? Students had to work together to come up with solutions to this problem, which allowed for open-ended responses. Participant D also discussed real-world application. Simply put, it was “taking the assignment outside of the classroom to see how it would apply in different areas” (D, l 33). Applying class work to real-world situations allows students to see the importance. According to 4 of the 7 participants, PBL gave students the ability to think “outside of the box”, make connections to the real-world, and think in ways they never had before.

Interview Question 3b. How have strategies you’ve used helped students develop creativity skills?
All participants again shared examples of how they used creativity within their classrooms to support PBL instruction. Many gave examples of how students used various classroom and home materials to make things to demonstrate understandings of concepts. Many (4 out of 7) discussed the connection between tasks in the classroom and the real-world. Another common theme was student choice.

Participants A and C focused on making connections to the real-world when demonstrating creativity. Participant A mentioned students working with the cafeteria staff to reuse materials such as vegetable cans, packaging materials, utensils, etc. to display knowledge through whatever project or presentation students choose. Participant C discussed how one student wanted to build a bird sanctuary for one of her tasks because she had pet birds at home. The teacher explained how the miniature bird sanctuary would prevent the birds from escaping, showed how the birds would eat, and showed how the birds would get fresh air all while being something birds could actually use. This demonstrated the student’s ability to think creatively while also relating to a real-world example.

Participant B felt that students showed their best creativity when allowed to generate their own idea for presenting information or generating their own problem to work through. The classroom teacher had posed a problem to the class about needing to stack cups without using their hands. Students were given cups and rubber bands and no further direction. Participant B goes on: “The ways that the kids came up with those ideas, I was like wow! I wouldn’t have thought of that” (B, l 86). Participant B noted that watching the groups work together and come up with solutions was as beneficial to Participant B as it was to the students.

Participant E had a similar viewpoint in that each solution was unique and different because students were able to work as a group to generate their own ideas. Participant E,
however, focused on teamwork. “Students were part of a team or worked with a partner to solve a problem. They worked together to show us the end result” (E, l 164). As illustrated through responses from Participant E, a lot of collaboration occurred in that classroom. Another area of creativity Participant E focused on was the interconnectivity with problems. Participant E stated when selecting a task, the question of, How does this one problem tackle multiple areas of content? remained in the forefront of planning. Allowing students to work through one single problem, and coming out of it with a multitude of content knowledge, was the goal of Participant E.

Participant F focused heavily on student choice and its importance in the success of PBL in this teacher’s classroom. One example shared was using a fictional text the student had read to think about a non-fiction piece that is connected. Students would then create something to illustrate the relationship. Participant F shared that one group made a clay museum of animals that have fangs and shared the different ways fangs were used. This was after reading the book *The Little Boy Who was Called Fang.* Another group made a game board while another made up a jingle, like a commercial, for the book. Participant F reiterated that students had a choice to demonstrate understanding of knowledge focusing on their own style of creativity. Participant F also noted that by allowing students to express themselves in a way that was meaningful to them, students wanted to learn from one another. Student would ask one another, “I would like to know how you did that slideshow. Can you show me?” Participant F stated, “It created kind of a community of learners. It was a safe environment for them to express their creativity” (F, l 104).

Participant G shared examples of students using art to illustrate their thinking. An example was shared that while reading *Skeleton Creek,* students would draw out what they thought was happening in the book and what might happen next. For students that Participant G
worked with, writing was a challenge. Since drawing was an outlet that students enjoyed, it allowed them to express themselves in a way that gave meaning to the student and demonstrated understanding to the teacher. Participant D stated that each solution to a problem was unique by saying, no two solutions are the same. Participant D also noted that when students present solutions to the class, others can see how it applies, which Participant D felt was beneficial.

Interview Question 3c. How have strategies you’ve used helped students develop communication skills?

An overarching theme in discussing communication fell around collaboration and teamwork as seen in Table 6.

Table 6. Interview Q3c: Strategies to Develop Communication

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<tbody>
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<tr>
<td>Involve Community</td>
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<td></td>
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<tr>
<td>Teamwork</td>
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</table>

All participants felt they needed to teach students how to effectively communicate with one another. Participant E discussed how students needed to be taught how to ask specific questions rather than just saying, “I don’t get this” or “I don’t understand.” Participant E explained students were taught how to effectively express exactly what they needed help with or how to ask a question. This was done through a lot of practice, modeling, and patience. By the end of the year, however, students were “pros” at asking specific, intelligent questions that guided them to the solution.

Participant F also felt passionate about teaching students how to communicate effectively: “We spent a lot of time at the beginning of the year talking about what effective
communication was” (F, l 126). Participant F went on to share examples of games they played to learn communication.

One game was like the old telephone game where if you don’t clearly enunciate or you don’t clearly communicate an idea, by the time it gets through several people, it’s completely different than what you started with. (F, l 128)

Another example Participant F shared had students standing back to back holding six pretzels. One student had to design something using the pretzels and explain to their partner how to make the same design. Once finished, they would compare their designs and discuss where miscommunication hindered the task. These examples demonstrated the effectiveness of modeling.

Participants A and B discussed the importance of all students having equal voice when working together. They agreed it is important for teachers to monitor students working in groups. Participant B reported, “You always have one student that wants to be the leader in charge and take over” (B, l 96). Participant A stressed that, as the teacher, you have to make sure all students are staying actively involved because you’ll always have that one who will stray and just watch everyone else do all the work. Both agree that by teaching and modeling good communication skills, students have the ability to work together to produce an end product.

As explained by Participant C, another way to foster communication among students is to facilitate tasks that involve community members. For one task, students had to interview a community member and report findings to the class. Interview questions were crafted by a group and conducted by phone, email, or in person. Then, groups presented their final products to the class and to parents, and the audience asked questions. They had to be prepared for this public forum and had to demonstrate effective communication skills.
Participant D summed up developing communication skills through modeling, allowing students to communicate amongst themselves, and ensuring students stayed on task. Participant G echoed modeling allowed for stronger development of communication skills. Participant G stated that, in the beginning, students did not want to talk to one another in a group, did not know how to ask specific task-related questions, or even had the confidence to talk in front of others. However, the more they worked on it, as a team, they “finally started opening up” and communicating with peers, teachers, and others. It also allowed students to see the importance of “finding their own voice” and realizing that “my voice matters.” Participant G felt this was one of those “ah-ha” moments for students.

Interview Question 3d. How have strategies you‘ve used helped students develop collaboration skills?

Five out of seven participants agreed that collaboration and communication go hand-in-hand. Participant A stated, “If they’re not communicating and collaborating with each other, then they won’t work well in a group” (A, l 83). Participant E reported that communication and collaboration are really tight together. “In order to be effective at collaboration, you had to be able to communicate with one another.” Participant E also noted that students realized, sometimes their best friends weren’t the best communicators, therefore should not be in my group if I want to do well. This realization by Participant E that working with others and finding out who you work better with allows for a more productive working environment. Participant B focused on working together to solve a problem. This included communicating effectively with one another to work as a team. Both ideas relate to teamwork and the ability to share ideas to produce an effective end product.
Participant B went on to share that the classroom teacher did not tell students how to solve the problem or how to work together. Students had to figure it out. Students had to learn each other’s different styles and how to work with each other to get the problem solved. Participant C agreed that teamwork is key. Utilizing a student’s individual strengths was a way many groups operated. Participant C stated, “I didn’t want any of them just sitting there, waiting on others to do something. They all chose a job every day” (C, l 149). A job was a student’s role in the group: facilitator, time keeper, recorder, illustrator, etc. Many groups switched jobs so that they could learn from one another, but they always worked together. Participant G agreed that just being able to work together gave many students the comfortability to share ideas and thoughts and express themselves in ways they never had before.

Participant D also discussed how some students would sit back and let the others do all the work. So, the teacher/leader in the room had to somehow “draw those other kids in (D, l 58)” and get them to work together.

Several participants mentioned students struggling with the idea of working with classmates they did not like. Participant C shared the following idea with students:

You know what, when I got this job I didn’t get to choose everybody I work with. I adapted to the people I work with because that’s what you have to do in the real world.

So, you’re going to learn to work together. (C, l 160)

Students did learn to work together; however, it did take a while for some. Participant F shared a structured lesson used with students to demonstrate collaboration. Then, students practiced with examples and non-examples of good collaboration. The focus of the lesson was providing them with specific, precise feedback and “encouraging them to inquire respectfully.” Participant F went on to share
I think that pays off, not just in our classroom, but at home or as they’re moving on up through elementary school and middle school. To be able to state something in a way that’s respectful and kind. (F, l 181)

Teaching students the importance of collaboration and how to work together well (instead of just separating tasks while sitting in a group) is an important skill to learn.

Interview Question 3e. How have strategies you’ve used helped students develop citizenship skills?

Respect (5 out of 7) was a common theme that emerged in response to this question. Another common theme was peer-to-peer support (4 out of 7). Both of these ideas focused on using a student’s strengths to support one another. Table 7 illustrates responses from each participant.

Table 7. Strategies to Develop Citizenship

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peace circles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peer-to-peer support</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive attitude</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respect</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Participant C explained that citizenship within the classroom meant “learning to love each other.” Participant C explained the use of peace circles in the classrooms as a means to solve problems. “Everybody would sit in a circle and we would talk about things that didn’t go well and how we could do better” (C, l 173). Students would use this opportunity to build each other up, saying, “You messed up, but we forgive you. Tomorrow you have to work harder.” Participant C further stated, “Students want to do better because they want to, not because the teacher is making them” (C, l 184). Peace circles were used to keep peace and ensure students were held accountable.
Participants E and G discussed focusing on students’ strengths to build peer-to-peer relationships. If one student was struggling, Participant E would find a student who was succeeding to provide help. Participant E noted, “Help doesn’t look like giving the answer. Help looks like explaining the processing and using fifth-grade language as opposed to teacher kind of language” (E, l 331). Furthermore, Participant E stated this was important for students to feel empowered but also to feel comfortable giving and taking feedback from peers. “There are moments you need help. We are in this together” (E, l 339). Participant G concurred by stating, “Everybody had a voice. A peer sitting beside a student would offer assistance. It was great to see students asking each other for help and feeling comfortable to do so” (G, l 179). Participant F noted that some students think differently. In our classrooms, we are seeing if we can encourage that and still be successful thinking in a different way.

Interview Question 4. Are there specific strategies that contributed to stronger development of critical thinking, collaboration, creativity, communication, or citizenship? Explain.

The majority of participants’ responses (6 out of 7) revolved around communication and collaboration skills. Getting students to work together and effectively communicate seemed to be the biggest areas of focus. Participant A shared that, as a teacher, monitoring students closely to make sure they are staying on task and communicating was vital. Additionally, Participant A stated, “Often, facilitation was necessary to show students what was expected (especially in the beginning)” (A, l 116). Participant C agreed that facilitation was necessary early on: “I’m going to guide you, but I’m not going to tell you everything. I’m going to give you these questions to think about but I’m not going to give you the answers” (C, l 201). This statement is what Participant C believed helped more than anything. Elementary students needed guidance. For
example, give students choice, but give them structured choices. Participant B summed up strategies that helped to develop skills as structured collaboration and monitored communication.

Clear expectations and guidelines were also common strategies discussed by participants. Participant D noted that very clear guidelines of what students needed to do was something that was important. When just “thrown in,” students became frustrated and did not understand what to do. Participant E agreed, stating students need to know what is expected. “I would say here is what I want done in X amount of time” (E, l 374). Students didn’t just have a “free-for-all” learning experience. Additionally, the goal in Participant E’s classroom revolved around the following question: “What are we learning and how do we demonstrate that learning?” Focusing on those things brought out the best from the students.

Participant F felt that modeling and practice were strategies that supported collaboration. “I think the modeling at the beginning, the practice at the beginning, and defining things at the beginning were pretty key” (F, l 249). Participant F also utilized rubrics as a means of assessment, showing students “this is what I’m looking for” and allowing them to work through problems together. Collaboration and communication were important skills developed through PBL instructional strategies as described by responses from 6 participants.

Interview Question 5. Based on your teaching experiences, what are some strengths of using PBL in elementary classrooms?

Responses to this question allowed the researcher to glean the pride that teachers had at the successes within their classrooms. Many participants (6 out of 7) described the pride they had in their students upon completion of a task, passing an end of year test for the first time, and the engagement of students in tasks. Participant G described the strength of a PBL classroom.
The kids were up, moving around the classroom. Someone was sitting the floor. As a support teacher, you walk in there for the first time and think “What in the world are they doing? The teacher has no control of the classroom.” But yet, in reality, the teacher is working with two students in one corner. Three kids are working individually. One corner, students are reading, another some are coloring a scene for a project and they were all super engaged. That was one of the things I truly enjoyed, moving kids to another level of student learning. (G, l 242)

It was chaotic, but it was controlled chaos. Students were thriving, learning, moving, and engaged in learning.

Movement was a big piece of PBL that participants felt was a strength. Participant B agreed that PBL instruction helped students with ADHD because they had the ability to move. They could get up, move around, learn how to calm themselves, and not be “stuck in a seat all day.” They had to learn how to communicate and work with teammates in order to be successful. Participant C agreed that movement was a strength. “Kids are so overstimulated. They come to school in a traditional classroom and are expected to just sit down and listen to the teacher all day. They are not there mentally” (C, l 258). PBL allows students to see it, touch it, move around, explore, and discover. Participant C concluded, “Somebody can tell you a million times, but once you do it, it clicks. PBL keeps them awake, motivated, and wanting to work” (C, l 269). Learning how to work with others is a real-world experience that students gained through this experience.

Participant D noted that a strength of PBL was in the creativity of finding real world experiences. “We have a tendency, sometimes, to become imitators of what we hear. So, as the students are listening to us, they just do it because we say it” (D, l 84). PBL gives students the
opportunity to see why things work, and therefore, see the practical application of things. Participant F shared, “I saw acquisition of knowledge that was far above and beyond anything I could have presented to them” (F, l 262). Participant F goes on to explain how trust was built between students as well as between the students and the teacher. Working together was a key strength, and learning how to work together constructively – not in a “mine is better” way – is imperative.

Creativity in students was also a strength noted by several participants. Participant F shared a game that students created to display knowledge of content. The students who created this game had yet to pass a Standards of Learning (SOL) test. However, they were able to express their knowledge through a board game, and Participant F shared “that was the proudest I’ve ever seen them.” In that moment, they were very successful. Participant A also shared that students learned more from the experience of presenting what they had learned than through a paper/pencil assignment. “Some kids do better with hands on activities and you can see them excel” (E, l 134), stated Participant A. Seeing the growth in students through this process was as beneficial to Participant A as it was for students. Being able to share their knowledge in a way that was meaningful was a great strength of PBL.

Interview Question 6. Based on your teaching experiences, what are some concerns or challenges with implementing PBL?

The main concerns or challenges participants noted with implementing PBL were time, organization, trust, and funding as noted in Table 8.

Table 8. Concerns/Challenges with Implementing PBL

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</thead>
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<td>Funding Organization</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When discussing time, participants mentioned time planning, time restraints due to pacing guides and state mandates, and time spent on each PBL. Participant E explained that deciding how much time to devote to each PBL was a challenge; the challenge was greater since it was the students’ first time completing a PBL task. In the beginning, students don’t understand what to do, ask a lot of questions, and need you to “hold their hand” through a task. Furthermore, according to Participant E, the more you do PBL the more students understand what to do, how to work together, how to think critically for themselves, and how to become less dependent on the teacher. Participant E also mentioned how staying focused on the task was important; otherwise, you could “go down a path you did not intend.” Sometimes, that is valuable, and sometimes, that is not. You have to distinguish between what is important and what is not.

Participant E reported that students need to learn that as well.

Participant C discussed the time it took to plan for PBL. As a group, teachers would spend time together planning a PBL lesson. “It took a lot of work. The planning time took forever” (C, l 374), stated Participant C. However, once the actual planning was complete, the implementation was easy. Participant F agreed that planning took a lot of time, but time was valuable: “If you put in the work up front, it’s much easier in the long run” (F, l 319).

Anticipating road blocks, preparing for questions students may ask, organizing resources students will need, and prompting questions you can ask students are all important in the preparation for PBL.

Another challenge was funding. When selecting PBL tasks, materials and supplies were something that teachers kept an eye on. Participant C felt providing materials for students was difficult, especially if students were not able to provide materials for tasks themselves. “A lot of
money was spent out of pocket, even though we spent the school’s money, too” (C, l 322), stated Participant C. “Teachers were given additional funds to purchase materials” (E, l 546) as it pertained to the study period, stated Participant E. Now that we are not doing it full-fledged, the money is being spent elsewhere, stated Participant E. Participant C also felt that larger class sizes impact the ability to fund certain PBLs, especially ones that require lots of materials.

Another challenge came from Participants A and B, who both noted that PBL was not used in all classrooms, both within the school and beyond. Both Participants A and B mentioned students struggling at the middle school because they were used to PBL instruction in elementary school. Therefore, a traditional learning environment where “the teacher wants you to do it a certain way” was challenging for students. This challenge was brought back to PBL teachers as students visited during open house, summer break, or just through casual conversation. Anecdotal conversation among teachers within the school and the division also gave participants A and B this information.

A final challenge mentioned was trust and buy-in from administration. Participant E noted that, while not at this school but others in which he worked, “buy-in from above” was challenging. When administration or visitors walked into a classroom, they saw a lot going on. It was noisy. Participant G described PBL as “unstructured structure”: from the outside looking in it was chaotic, but the teacher knew what was going on, students were on task, and there was a purpose. Participants C, E, and F agreed that it may seem noisy and hectic, but the students were productive. Therefore, Participant E reiterated that trust from leaders was key. Leaders need to understand that PBL can be noisy and chaotic. However, this process has the ability to teach students the importance of collaboration, creativity, and effective communication.
Interview Question 7. Based on your experiences with PBL, have you continued using PBL in your classroom? Why or why not?

All seven participants reported that they continue to use PBL in their classrooms, but all not as much as they would like. For Participants A, B, and D, as support staff, they support the learning environment by the classroom teacher and do not lead instruction. However, each mentioned continued use of strategies such as hands-on experiences, communicating with peers, and working together with their students.

Participant C discussed using “mini-PBLs” that are more project-based than problem-based. One difficulty Participant C noted was the lack of a team among teachers; therefore, it is more difficult to do PBLs this year. This participant emphasized, “It is hard when you don’t have everybody on board, so I haven’t done PBLs as much” (C, l 406). Participant E noted that some components or aspects of PBL are being used, but the scheduling and structure of classes this year has made it more difficult to do “full-fledged PBL.” Participant E liked the level of excitement from students when using PBL, liked students doing hands-on activities to demonstrate knowledge, and observed allowing students to work together on tasks as beneficial.

Participant F continues to use PBL because “I just love the look on the kids’ faces when they’re engaged, when they’re excited” (F, l 328). Scheduling was noted as the reason why PBL is not being used as much by Participants C, E, and F. Participant G has changed positions since the study period. Although Participant G is not using PBL, many of the strategies of PBL are being incorporated. However, PBL instructional strategies continue to be used by all 7 participants in various ways as reported through responses.

Interview Question 8. Is there anything else you would like to add?
An overwhelming response by participants was to encourage others to try PBL. Participant F shared, “I really think all teachers should challenge themselves to do PBL. Not because of the benefit to the students but because of the benefits to a teacher. You just learn so much more about your kids” (F, l 427). “It’s overwhelming, but use baby steps” (F, l 366), encouraged Participant F. Participant F also discussed the importance of students explaining their thinking. That could be a baby step. Participant F continued to encourage others to establish a collaborative classroom where students feel safe to express themselves, ask questions, work together, and fail. Participant F had the following goal for her PBL classroom.

I want to know that you’re thinking. I want to know that you’ve put some thought into it and that you’ve learned something from the process. And I never want you to get into a situation where you think there’s only one answer because very few things in life are really like that. (F, l 405)

Participant C agreed that everyone should at least try PBL. By trying PBL, “maybe people would see what kids can do, and realize, this works” (C, l 424). Participant E agreed and stated that “PBL doesn’t necessarily have to be large in scope. Start small and incorporate the basic components of PBL into what you do. Encourage students to work together. Relinquish some control within your classroom and give students the power” (E, l 665). Participant A explained, “It uses a different mindset from the teacher. You’ve got to kind of get out of that ‘I’m in control phase’ and allow kids to have the opportunity to be in control” (A, l 175). This does not mean it’s a free-for-all, but students can be allowed to have more ownership in their own learning. Participant F also explained that failure is acceptable.

Teachers need to be a little bit prepared to be a little bit uncomfortable and try new things. If it’s a total disaster, it’s okay. Kids need to see adults model
failure. They need to hear adults say, ‘I didn’t do this the best. What could I have
done to make this better? What is not making sense?’ This shows adults make
mistakes, too. I think PBL brings that into a classroom. (F, l 413)

Participant A also noted that it is okay to take a risk, and it is okay to fail. That is the hardest
part for teachers. All seven participants stated that using PBL prepared students for real-life.
Students were able to communicate effectively, work together, and solve problems. In a world
that is ever changing, students need to be prepared to tackle the unknown.

Findings for the Research Question

The research question was, What key strategies of PBL instruction contributed to the
development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity,
communication, collaboration, and citizenship for fourth and fifth grade students at one
elementary school in Virginia? From the data analysis identified seven findings regarding the
development of the Profile of a Virginia Graduate’s expectations that supported this research
question. Further explanation of each finding is discussed in Chapter 5.

The data analysis produced 10 key strategies that participants felt contributed to the
development of the critical thinking, creativity, communication, collaboration, and citizenship.
Table 9 depicts strategies of PBL instruction that emerged during analysis. A sample of data
analysis is included in Appendix G. The table is prioritized by the number of participants who
discussed each specific strategy, either directly or as inferred by the researcher. The frequency
word count for each strategy falls in line with the number of participants accordingly. The 10 key
strategies that participants thought contributed to the development of the 5 C’s are highlighted. A
strategy was categorized as a key strategy if over 50% of the participants referenced it during any
part of the interview more than 12 times - (averaging once per question).
Table 9. Strategies of PBL Instruction that Emerged During Data Analysis

<table>
<thead>
<tr>
<th>Strategy Used in PBL (actual or inferred) by participant</th>
<th># of Participants referred to this strategy</th>
<th>Word count frequency</th>
<th>Examples of Supporting Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asking Questions</td>
<td>7</td>
<td>28</td>
<td>Express to me what you need help with; guide students on how to ask that question.</td>
</tr>
<tr>
<td>Collaboration</td>
<td>7</td>
<td>37</td>
<td>Learn to work with others. They had to work together.</td>
</tr>
<tr>
<td>Communication</td>
<td>7</td>
<td>31</td>
<td>By the end of the year, students were able to openly communicate with peers.</td>
</tr>
<tr>
<td>Modeling</td>
<td>7</td>
<td>24</td>
<td>Introduced, model, then let them be creative.</td>
</tr>
<tr>
<td>Real-World Relevance</td>
<td>7</td>
<td>21</td>
<td>Taking the assignment outside of the classroom to see how it would apply in the real-world.</td>
</tr>
<tr>
<td>Small Groups</td>
<td>6</td>
<td>19</td>
<td>Student were able to openly express themselves in small groups.</td>
</tr>
<tr>
<td>Student Choice</td>
<td>5</td>
<td>16</td>
<td>It was their choice. Students researched then decided what kind of problem to study. Always give them specific choices.</td>
</tr>
<tr>
<td>Hands-On Learning</td>
<td>4</td>
<td>20</td>
<td>A hands-on experience on the concept being instructed.</td>
</tr>
<tr>
<td>Peer-to-Peer Relationships</td>
<td>4</td>
<td>13</td>
<td>Allow students to communicate among themselves.</td>
</tr>
<tr>
<td>Student-centered learning</td>
<td>4</td>
<td>18</td>
<td>More facilitating than actually teaching in front of the class.</td>
</tr>
<tr>
<td>Respect</td>
<td>5</td>
<td>9</td>
<td>It all came down to being able to respect the other person’s thoughts and ideas.</td>
</tr>
<tr>
<td>Individualized learning</td>
<td>3</td>
<td>10</td>
<td>Passion projects - everyone did their own individual thing.</td>
</tr>
<tr>
<td>Independence</td>
<td>2</td>
<td>5</td>
<td>The teacher is not there point out this is what this is. Makes kids think for themselves.</td>
</tr>
<tr>
<td>Open-ended</td>
<td>2</td>
<td>3</td>
<td>Start with some type of question or problem that is very open ended.</td>
</tr>
<tr>
<td>Organized/Structured</td>
<td>2</td>
<td>7</td>
<td>Giving clear guidelines for the task. Need organization and structure, but also need free thinking.</td>
</tr>
<tr>
<td>Context Clues</td>
<td>1</td>
<td>1</td>
<td>Use context clues to find the meaning of unknown things improve critical thinking.</td>
</tr>
<tr>
<td>Cross-Curricular learning</td>
<td>1</td>
<td>4</td>
<td>Incorporate part of this SOL, part of that subject…</td>
</tr>
<tr>
<td>High engagement</td>
<td>1</td>
<td>5</td>
<td>Kids enjoy it, therefore want to do it. Everyone has a part.</td>
</tr>
<tr>
<td>Imaginative detail</td>
<td>1</td>
<td>2</td>
<td>Allows students to be creative and use their imagination.</td>
</tr>
<tr>
<td>Involve Community</td>
<td>1</td>
<td>1</td>
<td>Interview community members to complete community service project. Involve community in PBL.</td>
</tr>
<tr>
<td>Justify thinking/responses</td>
<td>1</td>
<td>2</td>
<td>Forces students to justify thinking - don’t just take their word anymore.</td>
</tr>
<tr>
<td>Movement</td>
<td>1</td>
<td>3</td>
<td>Kids were up and moving around, not just sitting in their desk. Good for ADHD.</td>
</tr>
<tr>
<td>Multiple solutions</td>
<td>1</td>
<td>4</td>
<td>Open ended problems allow for multiple solutions. Makes kids think.</td>
</tr>
<tr>
<td>Ownership</td>
<td>1</td>
<td>9</td>
<td>Gave kids ownership over their ideas and thinking. There are moments you are going to shine and moments you’ll struggle.</td>
</tr>
<tr>
<td>Peace circles</td>
<td>1</td>
<td>1</td>
<td>At the end of each PBL we would sit in a circle and talk about things that didn’t go well and how we could do better.</td>
</tr>
<tr>
<td>Positive attitude</td>
<td>1</td>
<td>7</td>
<td>Keep a positive attitude because somethings you’ll have one person who constantly wants to be the boss of the group.</td>
</tr>
<tr>
<td>Self-discovery</td>
<td>1</td>
<td>3</td>
<td>Kids would discuss things on their own.</td>
</tr>
<tr>
<td>Self-motivation</td>
<td>1</td>
<td>1</td>
<td>I have to contribute my part if I don’t want my friends to be mad.</td>
</tr>
<tr>
<td>Summarizing</td>
<td>1</td>
<td>1</td>
<td>Pull all the information together in their final presentations.</td>
</tr>
</tbody>
</table>

Table 10 illustrates the 10 key strategies identified by participants and to which expectation from the Profile of a Virginia Graduate it contributed towards student development. The strategies of hands-on learning and real-world relevance contributed to the development of all five expectations. Collaboration and student choice contributed to the development of four of the five expectations. Asking questions, communication, and peer-to-peer relationships contributed to the development of three expectations. Modeling contributed to the development of two expectations whereas student choice only contributed to creativity.
Table 10. *Strategies That Contributed to Development of 5 C’s*

<table>
<thead>
<tr>
<th>Strategies That Contributed to Development of 5 C’s</th>
<th>Critical Thinking</th>
<th>Creativity</th>
<th>Collaboration</th>
<th>Communication</th>
<th>Citizenship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asking Questions</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Modeling</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Real-World Relevance</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Small Groups</td>
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<td>Student Choice</td>
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<td>Hands-On Learning</td>
<td>X</td>
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<td>Peer-to-Peer Relationships</td>
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<td>Student-centered learning</td>
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</table>

Finally, Figure 3 summarizes these key strategies identified by participants that contributed to the development of critical thinking, creativity, communication, collaboration and citizenship in their fourth and fifth grade students during the study period and the number of participants who discussed each strategy.

Figure 3. *Key Strategies of PBL Instruction that Contributed to the Development of the 5 C’s*
Summary

The participants’ responses to many of the interview questions illuminated their professional opinions about using PBL in their elementary classrooms. All participants felt PBL was a beneficial teaching method and encouraged others to try it in their own classrooms. Most participants reported that communication and collaboration were key skills that were taught, practiced, and built upon through PBL instruction. While not one specific strategy was identified as increasing all five skills, findings 2, 3, and 5 indicate strategies that increased certain skills. The data analysis also specified 10 strategies that contributed to the overall development of all 5 skills.

Participants noted that providing students the opportunity through a structured problem to work together to solve the given problem as well as promoting a safe environment for students to share, ask questions, and learn from one another are strengths of PBL instruction. While most participants felt PBL was implemented successfully during the study period, challenges were present. One of the greatest challenges mentioned was time. Participants explained that time spent for planning PBL instruction was very time-consuming. They also stated that, in the beginning, taking time to teach students how to communicate and collaborate was key to the success of PBL.

The analysis based on responses of the seven participants to the eight interview questions led to some emerging themes within the data that are discussed in Chapter 5. Additionally, the next chapter addresses strategies for practitioners based on the findings.
Chapter 5: Findings, Summary, and Conclusions

Introduction

The purpose of this study was to identify key strategies teachers reported using during the implementation of problem-based learning (PBL) in fourth and fifth grade classrooms during the 2017-2018 and 2018-2019 school years. Furthermore, the study reports what strategies aided in the skills development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship. One primary research question was used to collect and analyze data on the topic: What key strategies of PBL instruction contributed to the development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship for fourth and fifth grade students at one elementary school in Virginia?

Overview of Findings

1. Participants indicated that their implementation of PBL was successful for students.
2. Participants indicated that working in small groups increased communication and collaboration skills.
3. Participants indicated that student-centered learning and student choice aided in the development of creativity and communication skills.
4. Participants indicated that PBL instruction increased students’ critical thinking skills.
5. Participants indicated that peer-to-peer relationships aid in the development of citizenship skills.
6. Participants indicated that modeling was a helpful method to teach students PBL strategies.
Participants, when discussing PBL, interchanged the idea of problem-based and project-based with the general term PBL.

Discussion of Findings

Participants indicated their implementation of PBL was successful for students (Finding 1). All seven participants shared through personal stories and experiences that students made academic and social gains from PBL instruction. Research from Koray et al. (2008) supported that students participating in PBL performed significantly better on a problem-solving skills assessment than on an assessment after receiving traditional instruction. Koray et al. continued, stating “students receiving PBL instruction developed problem-solving skills, enhanced communication, and improved group working skills, as well as with the acquisition of knowledge” (p.16). Participants in this study agreed that communication and collaboration skills improved through PBL.

Participants indicated working in small groups increased communication and collaboration skills (Finding 2). Six out of seven participants shared how working in small groups allowed students to freely share ideas, work as a team, and establish roles in order to complete tasks effectively. One participant shared that students realized working with a best friend might not be the best fit because they did not always communicate well. Neville (2009) supported the idea of working in a small group and noted that one of the most important differences between PBL curricula in the medical setting and traditional medical school curricula lies in the learning environment. Furthermore, Neville stated, “PBL curricula use small group tutorials with a student-centered approach, active learning, the use of cases or problems, and a significant amount of time for independent study” (p. 2). Participants in this study agreed that
using small groups to facilitate PBL allowed students to develop better communication and collaboration skills.

*Participants indicated that student-centered learning and student choice aided in the development of creativity and communication skills (Finding 3).* Five out of seven participants discussed the idea of allowing students a choice in either the PBL or in the presentation of knowledge learned through PBL activities. By allowing students a choice, it became more meaningful to students. It also allowed students to utilize their own personal strengths and creativity to demonstrate knowledge and understanding. Allowing student choice also put the student at the center of their learning. Savery (2006) defined *PBL* as an instructional, student-centered approach that encourages learners to research, integrate theory, and apply knowledge and skills in order to develop a solution to the defined problem. Colley (2008) agreed that project-based learning is a student-centered teaching approach in which students produce outcomes by stating and answering research questions that are relevant to students’ lives. Also, Colley stated, “Students are encouraged to take responsibility for their own learning” (p.23). Five out of seven participants felt allowing students choice and four out of seven felt focusing on student-centered learning improved the development of creativity and communication skills.

*Participants indicated that PBL instruction increased students’ critical thinking skills (Finding 4).* All seven participants felt that students developed critical thinking skills through asking questions and finding real-world relevance through the PBL task while simultaneously becoming independent thinkers. Research on critical thinking involved in PBL from the Virginia Department of Education (VDOE, 2019) stated that students need to identify issues, formulate questions, discover multiple solutions, and make inferences. Participants felt that PBL provided students with the opportunity to learn, develop, and expand on critical thinking skills.
Participants indicated that peer-to-peer relationships aid in the development of citizenship skills (Finding 5). Five out of seven participants felt that working together through peer-to-peer relationships was a strength of PBL. PBL allowed students to work together constructively and provide feedback to one another in a non-threatening way in order to promote respect among students. Students need opportunities to demonstrate trustworthiness, respectfulness, fairness, responsibility, and caring (VDOE, 2019). Learning about the past, participating in the present, and caring about the future can produce strong citizens. Allowing students to work together (while focusing on individual student strengths) promoted the development of citizenship skills.

Participants indicated that modeling was a helpful method to teach students PBL strategies (Finding 6). PBL instruction is not something that came naturally to neither teachers nor students. All seven participants felt that it was successful in their classrooms due to modeling. Elementary-aged students need guidance on how to work together, how to communicate their thinking, and how to provide constructive feedback. PBL gives students a structured opportunity to practice these skills with guidance and facilitation from teachers. Hmelo-Silver (2004) described the teacher as a facilitator rather than a provider of knowledge. The teacher is able to model good strategies for thinking and learning and scaffolds student learning through modeling and coaching. Sage further explains a strategy for using PBL in elementary classrooms of “model/coach/fade” (p. 21). To facilitate effective small groups, the teacher may need to model a skill, coach group members on that skill, and fade teacher input to allow the groups to do it on their own. Participants felt modeling was important for PBL instruction in order for students to successfully develop critical thinking, creativity, communication, collaboration, and citizenship skills.
Participants, when discussing PBL, interchange the idea of problem-based and project-based with the general term PBL (Finding 7). When discussing PBL in their classroom, four out of seven participants interchanged the terms problem-based, project-based, and PBL. Many participants discussed projects they used or assigned; others simply noted the acronym PBL. The Buck Institute for Education (2018) clarified that PBL is typically conducted in a smaller time frame (a class period, a simpler problem) where project-based learning (PjBL) encompasses a longer period of time and often includes multiple tasks, disciplines, and responses. Most definitions of PBL focus on student-centered learning, real-world relevance, and collaboration (Barrows & Tamblyn, 1980; Hmelo-Silver, 2004; Marra, Jonassen, Palmer, & Luft, 2014; Savery, 2006). Although participants interchanged the terms, the idea of student-centered learning through a real-world problem remained at the forefront of their responses.

Practitioner Implications

Elementary school principals interested in supporting the implementation of PBL in individual classrooms or as a school-wide initiative should consider the findings of this study upon implementation.

1. **Principals should provide and support training to teachers interested in PBL implementation.** This will allow teachers to gain background knowledge on PBL in addition to learning how to implement and facilitate it in classrooms. The data analysis suggested that PBL instruction encompasses key skills of communication and collaboration that are important for student success using PBL. This implication is associated with Finding 2.

2. **Principals should support teachers in the implementation by allowing them to take risks and give permission to fail.** PBL, as noted in Chapter 4, is often viewed as chaotic,
unorganized, and time-consuming. However, principals should be knowledgeable of the structure of PBL and what to look for in PBL classrooms. This implication is associated with Findings 1 and 6.

3. **School principals should ensure that teachers understand The Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship.** Through sharing the website http://www.virginiaisforlearners.virginia.gov with teachers as a means of professional development, discussing its resources, or demonstrating the profile’s expectations, principals can add to teacher’s knowledge of these expectations. This implication is associated with Findings 3, 4, and 5.

**Policy Implications**

The VDOE should consider the findings from this study, specifically Findings 2, 3, 4, and 5 surrounding strategies that increased The Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship. Looking closely at what strategies support the skills development in students in elementary classrooms will allow the VDOE to share specific strategies for teachers to use while implementing PBL. It would also provide information on specific strategies to include in resources allowing for the development of these skills in elementary students.

**Conclusions**

This study contributes to the body of research on key strategies teachers reported using during the implementation of PBL and what skills aided in the skills development of critical thinking, creativity, communication, collaboration, and citizenship. The focus on PBL in
elementary school, in addition to the Profile of a Virginia Graduate’s expectations, makes it specifically helpful for elementary principals in Virginia.

This study found that PBL is a worthwhile instructional tool for improving elementary students’ use of the 5 C’s. The data analysis suggested that PBL increased the development of critical thinking, creativity, and citizenship, but more specifically improved the areas of communication and collaboration. Participants indicated that modeling was a helpful method to teach elementary students PBL strategies. Participants shared students need guidance in how to effectively communicate thinking to peers and teachers. Participants also noted students need guidance on how to work collaboratively on a task because often times, students simply sit in a group and work individually on the part of the task to which they are assigned rather than collaborate on ideas, the process, and the product. Through PBL, students were able to develop and practice effective skills.

The data analysis also suggested that principal support is key for its success in elementary classrooms. Participants indicated that PBL, from the outside looking in, was noisy and chaotic. However, PBL allowed students to develop the key skills of collaboration, creativity, and communication while increasing critical thinking skills and citizenship. Through permission to try something new, to allowing teachers and students to be noisy and chaotic, principals supporting PBL instruction is important, as noted by participants in this study. Because the school principal serves as the instructional leader, the principal should encourage the implementation of research-based instructional strategies.

**Recommendations for Further Research**

Through findings from this study, the researcher has identified three recommendations for further research that expand upon the 5 C’s and implications for Virginia students.
1. To further examine key strategies teachers reported during PBL implementation, future research could focus on 1 of the 5 expectations established in the Profile of a Virginia Graduate. This would allow the researcher to focus on a specific skill and look at that one skill from a variety of lenses. School principals have annual goals in which they work towards, and the Profile of a Virginia Graduate’s expectations are often incorporated into these goals. It would be beneficial for school leaders to have data to support their annual goals.

2. This study could be adapted or expanded in order to gain more information on teacher reported strategies used during PBL implementation. It would be advantageous to do this study with different grade levels to see if strategies used to develop skills change with student age.

3. The study could be extended to the interviewing of students who were in fourth and fifth grade during the 2017-2018 and 2018-2019 school years. Interview questions could be adapted to obtain information from a student’s point of view and add to the current data set. The addition of student perceptions would benefit principals when looking for professional development opportunities to teachers surrounding PBL and the 5 C’s.

**Researcher Reflections**

As a principal serving a PK-5 elementary school with a passion for instruction, this study demonstrated the importance of support, resilience, and dedication of teachers. Principal leadership has transformed over my 15 years in education from a manager to an instructional leader. It is my job to embrace and encourage change, allow teachers to take risks, and be knowledgeable of good instructional practices. PBL is not new. However, it is new to teachers in
Virginia. Researching PBL and gaining insight from teachers through this study has allowed me to share research with teachers, encourage teachers to try something new, and embrace the VDOE’s initiative of the Profile of a Virginia Graduate.

I am pleased to have added to the breadth of literature surrounding PBL in elementary classrooms at one school in Virginia. Based on results from this study, I believe PBL is a worthwhile instructional tool that improved elementary students’ use of the 5 C’s and that principal support is key for its success. I hope that principals who wish to support PBL implementation at their school review the findings and reflect on their own practices. Finally, I encourage principals to implement PBL in their schools and support teachers who wish to implement PBL in their classrooms. For both principals and teachers, I hope they would utilize these findings to make informed decisions about PBL implementation.

Currently, our nation is in the midst of the COVID-19 pandemic. School systems suddenly went from normal, daily face-to-face instruction to being physically closed for the remainder of the year and moving to online instruction. As students and teachers transition to online learning in a matter of days, education continues. Thankfully, we live in a technology rich society and most students and teachers have access to online learning through a variety of platforms. PBL in the online learning world is a bit unchartered. However, the basic components of student-centered learning and real-world application are adaptable to online learning. Also, online learning allows students the time needed for PBL instruction, which is often a challenge in a face-to-face classroom. In today’s society, using online platforms to connect with colleagues, hold virtual meetings, or collaborate on projects are becoming the norm. Utilizing this pandemic to encourage virtual communication to complete assignments will allow students to begin developing this skill of virtual communication and collaboration. While not ideal for young
elementary students, it is not impossible. Teachers and students are resilient and are navigating these unchartered waters of online learning.
References


Alberta Ministry of Education.


Virginia Department of Education. (2019). Profile of a Virginia Graduate. Retrieved from


## Appendix A

Table 1. *Sources reviewed on the topic of problem-based learning*

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Research Questions/Purpose</th>
<th>Main Themes</th>
<th>Methods/ Data Sources</th>
<th>Findings/Important Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barron et al</td>
<td>PBL Challenge for 5th Graders:&lt;br&gt; 1. Create a design or model of the playground for the builders.&lt;br&gt; 2. Provide a site plan of the lot, the playground, and each piece of equipment.&lt;br&gt; 3. Provide a front and side view of the equipment with relevant angles, lengths, and depths.</td>
<td>Four principles of design that lead to doing with understanding rather than doing for the sake of doing:&lt;br&gt; 1. Learn appropriate goals&lt;br&gt; 2. Scaffolds to support both teacher and student&lt;br&gt; 3. Frequent opportunities given for formative self-assessment and edits&lt;br&gt; 4. Social organizations that encourage participation</td>
<td>Case Study - E Experiments Interviews</td>
<td>Want students to “do with understanding” but also to “learn with understanding”.&lt;br&gt; Tangible projects&lt;br&gt; Major hurdle in PBL – projects require simultaneous changes in curriculum, instruction, and assessment practices; changes that are foreign to students and teachers.</td>
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<td>1998</td>
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<td>Barrows</td>
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<td>(1986)</td>
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<td>Barrows, H. &amp;</td>
<td>Felt the system was producing physicians who knew subject, but did not have skills to use such knowledge or apply knowledge to different contexts/situations&lt;br&gt; Defined PBL as:&lt;br&gt; “The learning that results from the process of working toward the understanding or resolution of a problem. The problem is encountered first in the learning process and serves as a focus or stimulus for the application of problem-solving or reasoning skills, as well as for the search for or study of information or knowledge needed to understand the mechanisms responsible for</td>
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<td>Tamblyn, R.</td>
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<td>(1980)</td>
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<td>Author</td>
<td>Question</td>
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<td>Blumenfeld et al. (1991)</td>
<td>Why do project-based learning projects have a higher potential to help people learn? What are factors in project design that affect motivation and thought? What difficulties may students and teachers encounter with projects? How can technology support students and teachers as they work on projects so that motivation and thought are sustained?</td>
<td>What are projects? Relatively long-term, problem-focused, meaningful units of instruction that integrate concepts Two essential components of projects: 1) question/problem to organize or drive activities 2) activities result in series of products that result in final product that addresses driving question Project-based learning places students in realistic, contextualized problem-solving environments Projects build bridges between phenomena in classroom and real-life experiences Idea of projects goes back to Dewey – but without adequate support for students/teachers, innovative approaches will not be widely adopted. Qualitative Research study</td>
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<td>Buck Institute</td>
<td>Purpose – inform about project-based science instruction compared to PBL</td>
<td>Project-based science instruction Dewey and other progressive educators laid the curricular and psychological foundations for project based instruction. <em>The Child and the Curriculum, Dewey 1902</em></td>
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<tr>
<td>Colley (2008)</td>
<td>How does a learning strategy influence college students’ learning outcomes regarding industrial-oriented competences?</td>
<td>“Problem-based learning (PBL) is perhaps one of the most innovative pedagogical methods ever implemented in education. (p. 289)”</td>
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<td>Chung &amp; Chen (2016)</td>
<td>How does a learning strategy influence college students’ learning outcomes regarding industrial-oriented competences?</td>
<td>“Problem-based learning (PBL) is perhaps one of the most innovative pedagogical methods ever implemented in education. (p. 289)”</td>
<td>PBL question cannot be so constrained that outcomes are predetermined – leaving little room to develop own approach to answering question Students’ freedom to generate products in critical – through this process that students construct knowledge Technology: Will foster project-based education – obtaining, analyzing, sharing information, constructing products; sustain student motivation; support student learning and doing; supplement and compliment teachers’ instructional roles; enhance teacher knowledge Technology can supplement but not supplant the teacher in helping students with projects.</td>
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<td>Taiwan</td>
<td>First conceived in early 1960s – medical college – learning method to implement constructivism</td>
<td>Empirical data – classroom observations, analysis of teachers’ journals, semi-structural interviews, Quantitative (secondary approach), Survey – statistical analysis</td>
<td>Learning method – from static to dynamic</td>
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<tr>
<td>Research Objectives:</td>
<td>Learner-centered form of education – based on non-structural issues and process of active problem solving</td>
<td>All were satisfied with PBL</td>
<td>All were satisfied with PBL</td>
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<tr>
<td>1) Understand the actual thoughts and gratification of business and management students after receiving PBL.</td>
<td>PBL model (5 stages): analysis, design, development, implementation, evaluation Based on teamwork and discussion</td>
<td>Statistical data – significant differences in pre-test/post-test</td>
<td>Statistical data – significant differences in pre-test/post-test</td>
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<td>2) Understand the actual thoughts and gratification of business and management teachers after including PBL in practical monograph course teaching.</td>
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<td>PBL preferred teaching approach</td>
<td>PBL preferred teaching approach</td>
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<td>3) Understand business and management students’ changes in industrial-oriented competences after receiving PBL and their learning outcomes before and after PBL.</td>
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| Drake & Long (2009) | Project on Effectiveness of PBL criteria for defining instructional model: curriculum is organized around problems, not disciplines, with emphasis on cognitive skills and knowledge; uses small groups, student centers, teachers as facilitators; outcomes focus on skills development and motivation | Case Study – 16 in comparison group, 17 in experimental group 45 minutes science instruction over two-week period | PBL vs. direct instruction  |
| 4th Grade Science Classrooms – Visitor poses problem: Electricity unit – needs help to study in the dark due to limited use of light. “A review of the literature, while informative at the middle and high school levels, revealed considerably less research on the use of PBL at the elementary school level. Therefore, this investigation was designed as pilot | PBL is used as a method to promote students’ construction of knowledge through inquiry at the K-12 level. (pg 3) |                                                                                     | Instruction based on 4th grade 2004 North Carolina Standard Course of Study competency goals 3.03, 3.05, 3.06, 3.08, 3.09. Teachers facilitate – what students already know, what need to know, where to find info. Class collaboration |
study to examine efficacy of PBL with younger learners.” (pg. 4)

Research Questions

1. Is PBL more effective than a direct instruction/experiential model in increasing content knowledge?
2. Does PBL result in increased retention of information over time?
3. Does PBL affect students’ stereotypical images of scientists?
4. Does PBL result in higher levels of time-on-task than a direct instruction/experiential model?
5. Does PBL facilitate the transfer of problem-solving skills to other situations?

PBL is example of constructivist approach to learning. Dewey emphasized the need to provide educational experiences that were relevant to students through use of PBL.

Results:
Significant growth in PBL group’s content knowledge and test scores comparable to both group.

Same professor provided lessons for both groups; covered same content

PBL model: engagement, inquiry/investigation, problem resolution, debriefing
Researchers: 1 classroom instruction, 1 gathered data, administered assessments
Constraints – time frame due to high-stakes testing in Reading & Math
PBL requires students to use knowledge and skills in meaningful contexts.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Question</th>
<th>Methodology</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Estes, Liu, Zha, &amp; Reedy (2014)</td>
<td>How is teaching and learning currently conducted in STEM lab spaces? How can an existing STEM learning space be redesigned to promote student-centered approaches, interactivity, and distant collaboration with another institution?</td>
<td>STEM: Investigate pedagogical needs across related content areas, use findings to make informed lab design decisions</td>
<td>Case Study PS Questionnaire, interviews, focus group sessions</td>
</tr>
<tr>
<td>Friesen &amp; Scott (2013)</td>
<td></td>
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<td>Literature Review on inquiry-based learning</td>
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<tr>
<td>Study</td>
<td>Research Question</td>
<td>Findings</td>
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<tr>
<td>Geirer, et al. (2008)</td>
<td>Compare student science achievement under PBL to achievement under traditional instruction. Do students really show improved understanding as a result of standards-based practice, at a level sufficient to justify the long-term social and financial commitment required to sustain a reform effort?</td>
<td>Science Achievement in diverse learners in urban middle schools – 7th and 8th grade students; compared to remainder of Detroit Public Schools on high-stakes standardized test in science Reform efforts can be compromised, particularly in light of mandates and penalties associated with Elementary and Secondary Education’s NCLB act. Statewide standardized testing as best means to evaluate educational impact on students from reform efforts, for both political and economic reasons. Partnership between University of Michigan and Detroit Public Schools; financed by National Science Foundation’s Urban Systemic Initiative and Urban Systemic Program. Curriculum units used over 8- to 10- week units; inquiry investigations by driving questions. Professional development aligned with project-based inquiry model of curriculum units. Quasi-Experimental/Standardized assessments in science PBL was shown to be more effective in delivering content. Researchers point out that this study was conducted within a wider school reform, and that other factors may also have contributed to the results. Potential sample bias: Addressed potential influence of student absenteeism and attrition, biases in student selection due to tracking (participants selected by district officials who were mindful of equity issues), and school site and participant teacher selection factors. “Even highly aligned multi-component efforts at implementing standards require several years of enactment experience before student achievement results show consistent improvement (p.934).”</td>
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<td>Grant (2011)</td>
<td>How do learners create projects? How do learners choose to complete the learning tasks? From the perspective of students engaged in project-based learning, what influences their project work and learning?</td>
<td>Small sample size limits generalizability, however - Influence of classroom teacher on participants is great. While PBL afforded participants choice, challenge, and control of content, they relied on teacher to guide learning - Rely heavily on prior knowledge and experiences Case study 8th grade geography, private day school Themes describing what influenced learners’ work: 1) internal and external influences 2) beliefs about projects 3) tools for technology—rich environments 4) learning outcomes of and products</td>
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<tr>
<td>Han, Capraro, &amp; Capraro (2016)</td>
<td>How does STEM project based learning affect high-need students in the US in terms of academic achievement? Is stem PBL effective longitudinally?</td>
<td>STEM PBL – ill-defined task, contextual project; curriculum standards; strengths: engaging students in problem solving within the project individually and in groups while exploring strategies to solve Math achievement of Hispanic students and students at</td>
<td>Positive results for Hispanic students; no positive result for at-risk students.</td>
</tr>
<tr>
<td>Harris, Penuel, D’Angelo, DeBarger, Gallagher, Kennedy, Cheng, &amp; Krajcik (2015)</td>
<td>To what extent can project-based curriculum materials be implemented with fidelity? To what extent is fidelity of implementation related to instructional guidance from the district and prior achievement levels of students? What is the impact of project-based curriculum materials on student science learning that integrates core ideas, science and engineering practices, and crosscutting concepts? How does the impact of project-based curriculum materials vary by student background?</td>
<td>Materials are from Project-Based Inquiry Science (PBIS) curriculum. Treatment group implemented project-based science curriculum and received PD and use of curriculum materials. Comparison group received PD but used district-adopted textbooks. Follow pacing guide, teach same unit of study. Pilot test of assessment conducted one year prior to study.</td>
<td>Randomized Experiment S Six grade science PBIS curriculum improved student learning. District-level involvement adds to the efficacy of curriculum. Generalizations to K-12 Science: curriculum materials need to support teacher learning;</td>
</tr>
<tr>
<td>Hmelo-Silver, Duncan, &amp; Chinn (2007)</td>
<td>What and how do students learn using problem-based learning?</td>
<td>PBL and IL (Inquiry Learning) are not discovery approaches and are not instances of minimally guided instruction (p. 100). PBL – students learn content, strategies, and self-directed learning skills through collaboratively solving problems, reflecting on their experiences, and engaging in self-directed inquiry.</td>
<td>Use of scaffolding in PBL – reduce cognitive load, provide expert guidance, help students acquire disciplinary ways of thinking/acting</td>
</tr>
<tr>
<td>Hmelo-Silver (2004)</td>
<td>What and how do students learn using problem-based learning?</td>
<td>Definition: instructional method where students learn through facilitated problem solving. Students work groups to identify what they need to learn in order to solve problems, engage in self-directed learning, and apply new knowledge to the problem, then reflect on what they learned.</td>
<td>Case study/pre-post test or quasi-experimental designs comprise most of research on PBL. Problem-based learning cycle: Students presented with problem scenario, formulate and analyze the problem (identify relevant facts), generate hypothesis, apply new knowledge and evaluate hypothesis,</td>
</tr>
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</table>
Teacher is facilitator rather than simply providing knowledge. Teacher is an expert learner, able to model good strategies for thinking and learning, scaffolds student learning through modeling/coaching, fade scaffolding; responsible for moving students through process and monitoring group progress.

Goals of PBL:
1) Develop flexible knowledge
2) Develop effective problem-solving skills
3) Develop self-directed learning skills
4) Develop effective collaboration skills
5) Develop intrinsic motivation

Expands on pg. 239-241

| Holm (2011) | PBL methodology offers highly desirable benefits, yet implementation poses some practical difficulties within the current context of American classrooms. | PBL – student-centered instruction that occurs over extended time period. Students select, plan, investigate, and produce a product, presentation, or performance that answers a real-world question or responds to an authentic challenge. Teachers serve as facilitators, providing scaffolding, guidance, and strategic instruction as process unfolds. | Literature review PK-12 classrooms | Most quantitative, comparative studies originated outside the US
Studies identified in this review found PBL to be an effective means of teaching both content information and related skills. Students had greater gains in content knowledge than traditionally taught peers.
PBL is beneficial with positive outcomes including increases in level of student engagement, heightened interest in content, more robust development of problem-solving skills. |
<table>
<thead>
<tr>
<th>Reference</th>
<th>Question</th>
<th>Description</th>
<th>Methods</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horak &amp; Galluzzo (2017)</td>
<td>How well does learning middle school science in a PBL setting compare with learning the same material in a traditional, teacher-centered classroom for gifted students?</td>
<td>Challenges for gifted students – increasing expectation to prepare students for college and career by developing 21st century skills. PBL has emerged as practice in the repertoire of current teaching practices accessible in the general curriculum of schools with the potential to provide gifted students with skills, content, and dispositions necessary for college and career readiness expectations and 21st century skills. Dewey’s perspective included experiential learning Constructivist learning is understanding our interactions with the environment, cognitive conflict or puzzlement is the stimulus for learning and determines the organization and nature of what is learned, and knowledge evolves through social negotiation and through the evaluation of the viability of individual understandings. Results: academic and student perceptions favored PBL group – indirect and constructivist approach to teaching can outperform a more direct approach to teaching; students found PBL setting created better learning environment.</td>
<td>Quasi-experimental study – middle school science S Two-groups; pre-post study PD for teachers 3 teachers Standardized test (pre-post test) Questionnaire</td>
<td>The core concept of constructivism is that which we understand is a function of the context of the learner. (p. 31) Good topic sentence: PBL as a method has been studied more widely in medical schools than in K-12 education. Although research in K-12 has been sparse, it is rapidly growing, and there are some indicators of the strengths of PBL and how to maximize its effectiveness in both cognitive and non-cognitive domains (p. 32) Cognitive: Skills such as problem solving, questioning, and data literacy result from PBL. These outcomes are consistent with 21st century learning skills. Non-cognitive: interpersonal skills, service to the community, students perceptions of classroom experience; motivation Sage (1996) suggests non-cognitive outcomes of PBL may be more critical than content acquisition.</td>
</tr>
<tr>
<td>Hung &amp; Liu (2007)</td>
<td>What is the impact of the problem-based learning method on elementary school students’ academic achievement and levels of concept</td>
<td>Pretest/posttest – academic achievement test and open-ended questions (34 mc questions)</td>
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<td>Inel and Balim (2010)</td>
<td>What is the impact of the problem-based learning method on elementary school students’ academic achievement and levels of concept</td>
<td>Pretest/posttest – academic achievement test and open-ended questions (34 mc questions)</td>
<td>Quasi-Experimental/ Non-equivalent, pretest-posttest</td>
<td>The use of problem-based learning method in science and technology is more effective in enhancing students’ academic achievement.</td>
</tr>
<tr>
<td>Jones &amp; Brader-Araje (2002)</td>
<td>Impact of constructivism on education.</td>
<td>The focus on constructing meaning in the teaching-learning process resonates with prior beliefs because constructivist-based instruction firmly places educational priorities on student learning. Development of understanding requires the learner actively engaged in meaning-making. Knowing as a process.</td>
<td>Students bring with them a rich array of prior experiences, knowledge, and beliefs that they can use in constructing new understandings. Learning as active process, building on prior knowledge – goes beyond rote learning to meaningful learning – leads to deeper, longer lasting understandings. Collaboration – work together and share ideas; challenge each other’s perspectives.</td>
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<tr>
<td>Jones &amp; Eick (2007)</td>
<td>Focus: experiences of middle school science teachers within professional development school &amp; how collaboration supported implementation of new inquiry-based curriculum. How does the professional development school collaboration support inservice science teachers’ implementation of inquiry-based kits?</td>
<td>Inquiry-based teaching and learning – middle school science Worked with unlicensed secondary science education majors Inquiry-based learning kits developed by National science Resources Center include lesson plans and materials, provide framework for inquiry</td>
<td>Implementation of inquiry kits – collaboration through co-teaching; planning and troubleshooting – avoiding problems, directions, etc. Practical knowledge gains by in-service teachers: contributed knowledge gained from secondary education, sharing of ideas and knowledge; expansion of content knowledge as shared by pre-service teachers Supportive influence of collaboration (strengths and weaknesses)</td>
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<tr>
<td>Source</td>
<td>Question(s)</td>
<td>Methodology</td>
<td>Findings</td>
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<tr>
<td>Kain (2003)</td>
<td>Collaboration allows teachers to combine educational backgrounds (elementary and secondary)</td>
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<tr>
<td>Kirschner, Sweller, &amp; Clark (2006)</td>
<td>Is minimal guidance effective?</td>
<td>Origins of constructivism – knowledge is constructed by learners so they need to have the opportunity to construct and a common instructional format is ineffective</td>
<td></td>
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<tr>
<td>Koray, Presley, Koksal, &amp; Ozdemir (2008)</td>
<td>Purpose: Enhance pre-service teachers’ problem-solving skills by giving them the opportunity to understand the problem solving process. Is PBL effective on developing pre-service elementary school teachers’ problem solving skills? 85 pre-service elementary teachers 2 classes: 1 randomly assigned as experimental, other assigned as control Problem-solving skills inventory (PSSI) used</td>
<td>Mixed Method Qualitative research; Quantitative Results, Experimental approach, Experimental group – problem based learning, Control group – TI/ Semi-structured interview, Open-ended questionnaire</td>
<td>Students participating in PBL performed significantly better on PSSI than students in TI group. Quotes from interviews supported benefits of PBL group and improvement in teamwork, communication, and problem solving skills. Problem-based learning developed problem solving skills of pre-service teachers; enhanced communication, group working skills, and acquisition of knowledge.</td>
<td></td>
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<td>Krajcik et al. (1994)</td>
<td>How does collaboration and enactment help promote teachers’ reflection and learning through problem-based learning instruction?</td>
<td>Benefits from learning by doing go back to John Dewey – project-based instruction is one example of learning by doing. Constructivists – teaching and learning primary importance in how learners attempt to make sense</td>
<td>Case Study/ Videotaped lessons, Personal journals, Interviews</td>
<td>Constructivism – students learn by addressing authentic problem PBL requires driving question – students develop meaningful understanding while working on solutions to question</td>
</tr>
</tbody>
</table>
| How do teachers’ beliefs, knowledge, and contexts influence and limit new practices and visions? | Five essential features of project-based instruction 1) engage students, investigate authentic question/problem that drives activities, organizes concepts/principles 2) students develop series of products that address question/problem 3) students engage in investigations 4) involve students, teachers, stakeholders – collaborate about problem 5) promote students using cognitive tools | Good questions are feasible, worthwhile, contextualized, meaningful – but cannot be so highly constrained that solutions are predetermined  
Need for students to construct multiple representations and apply information  
Focuses on role of learning community & creating understanding |

| Lou et al. (2011) | Explore a learning behavioral model of project-based learning (PBL) for senior high school students in the context of STEM.  
Explore four variables of attitude, cognition, behavioral intention, behavioral effects and analyze influences on students’ attitudes, cognitions, and behavioral intentions on the effects of behavior for future STEM in PBL teaching | Taiwan  
No real connection to my interest, although good information on research of PBL to look at further if needed. | Text analysis Questionnaire survey |

In PBL, student learning is supported and coached by a faculty member whose role is to facilitate discussion-based learning.  
Primary characteristics: problem-focused, student-centered, self-directed, self-reflective, facilitative | Review of literature |

| | PBL developed out of an instructional need to help medical school students learn their basic sciences knowledge in a way that would be more lasting while helping to develop clinical skills simultaneously.  
The need for metacognitive skills increases in PBL – students become increasingly responsible for self-regulation of learning. | |
### Mitchell, Foulger, Wetzel, & Rathkey (2008)

**Six-week study of biomes.**

**Questions:**
1. How does the teacher negotiate topics, investigate activities, and final presentations with the children?
2. How does the teacher encourage the children to solve their own problems during Project Work?

**The Project Approach** – projects are in-depth investigations that involve students in design and investigative activities that result in a final project.

**Students involved in planning process:**
1. Develop their own questions about topic
2. Make predictions
3. How to test hypothesis?
4. Negotiate with teacher various ways to represent findings
5. Take time to solve own problems

**Project Approach can help children meet learning goals, form good self-concept, motive to investigate authentic problems.**

**Case Study – Observation**

3 phases of project work: 1) teacher selects topic based on desired learning outcomes, help students with questions to guide investigation; 2) students work in small groups to investigate; 3) culminating event or activity to summarize findings of investigation.

**Challenges:** resistant to change; stick with traditional approach; lack of guidelines (teacher’s manual); planning; assess learning; political pressure to teach standards.

**Supports that teachers can plan for projects that integrate grade-level standards.**

Hard to generalize findings to other classrooms because it was so specific.

### Merritt, Lee, Rillero, & Kinach (2017)

**How do researchers define PBL?**

**What components of PBL were explicitly identified salient to student learning?**

**Purpose of Study:** Examine what specifically quantitative research revealed about the effectiveness of PBL on student learning of math/science concepts from primary to secondary grades.

**Experimental, quasi-experimental/peer-reviewed journal articles**

In higher education, PBL is effective; but little is known about effectiveness in middle and elementary.

**Implication:** Investigate impact of PBL on teaching math to elementary students.
<table>
<thead>
<tr>
<th>Mergendol ler (2006)</th>
<th>Is there a difference in achievement, measured by pre and post test changes in macroeconomics knowledge,</th>
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<tbody>
<tr>
<td></td>
<td>- between students in PBL and traditional instructional environments?</td>
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<td></td>
<td>- Between students with different levels of verbal ability in PBL and traditional classrooms?</td>
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<td></td>
<td>- Among students with different levels of interest in learning economics, preference for group work, or problem-solving efficacy?</td>
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<td>In PBL, teachers coach students using suggestions for future study or inquiry but do not assign predetermined activities.</td>
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<td>PBL teachers wait for teachable moments before intervening or providing needed content explanation.</td>
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<td>Little research has been conducted with high schools comparing the effectiveness of PBL and traditional instructional approaches.</td>
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<td>Miller (2018)</td>
<td>How is the Harmony principle of oneness, in terms of mindfulness and meditation, taught at the Ashley Church of England Primary School?</td>
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<td></td>
<td>Definition - process where students engage in self-directed study, teachers act as facilitators. PBL is described as “an instructional method where student learning occurs in the context of solving an authentic problem.”</td>
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<td></td>
<td>Qualitative Case Study/ Semi-structured Interviews and focus groups</td>
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<td></td>
<td>Main focus in relation to my interest is the methodology – case study.</td>
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<td></td>
<td>Researcher conducted interviews herself.</td>
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<td>Neville (2009)</td>
<td>Can the Harmony principle of oneness be replicated in a faith-based, early childhood education classroom in the United States using the same methods as those of the Ashley Church of England Primary School?</td>
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<td>Newman, Ambrose, Corner, Evans, Morris-Vincent, &amp; Quinn (2003)</td>
<td>Cognitive basis of PBL: Is it a sound educational theory?</td>
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<tr>
<td>Sage (1996)</td>
<td>Purpose: Describe the characteristics of PBL as a curriculum development and instructional strategy at the K-8 level. Also to describe the effects of PBL on students’ learning. Elementary groups worked on plant problem from principal; secondary students worked on prairie problem around school.</td>
</tr>
</tbody>
</table>
| Sahli (2017) | Is PBL more effective than a textbook-based instructional model?  
What are teacher perceptions related to PBL methodology? | Dissertation |
|-------------|---------------------------------------------------------------|--------------|
| Savery (2006) | Definitions and distinctions of PBL | PBL vs Case-based learning  
- Both promote active learning, stds use higher-order thinking  
- Case – help learners understand important elements of problem so better prepared for future  
- Case – help develop critical thinking by assessing info provided and identifying flaws or false assumptions  
- Case – used to assess student learning after instruction  
- Case – diminish learner’s role in setting goals/outcomes for problem | |
| | Instructional, learner-centered approach encourages learners to research, integrate theory/practice, apply knowledge/skills in order to develop a solution to defined problem.  
Ability to think critically, analyze/solve complex problems, find/evaluate/use appropriate learning, work cooperatively, demonstrate effective communication skills, use knowledge to become continual learner  
Focused, experiential learning  
Evolved from innovative health sciences 30+ years ago; Barrows introduced tutorial process as instructional method; promoted student-centered, multidisciplinary education;  
Characteristics of PBL in K-12 education  
1. Role of teacher as a facilitator of learning | |
| | final projects; incorporated science and language arts  
Teacher as facilitator – teachers need to model a skill, then coach the skill, then fade to allow groups to practice skill on own.  
Teachers need to know subject and encourage student inquiry (key to PBL) | pre/post test for basic content knowledge | Unique issue to K-12 PBL – to explore complex, real-world issues, students may learn more by being assigned to a role of more authority than they as young students would have.  
The real difference between PBL and other active, experiential forms of learning is that PBL places students squarely in the middle of a messy, authentic problem that changes as you go along and has no one right answer. |
| Savery & Duffy (1995) | 2. Responsibilities of the learners are self-directed and self-regulated  
3. Essential elements in the design of ill-structured instructional problems as driving force for inquiry | PBL vs Inquiry-based Learning  
- Inquiry grounded in philosophy of Dewey – education begins with the curiosity of the learner  
- Inquiry – student-centered, active learning, focused on questioning, critical thinking, problem solving  
- Inquiry – teacher is facilitator of learning and provider of information  
- PBL – teacher supports process, does not provide information |

| Siew & Mapeala (2017) | Does TM-PBL teaching foster students’ motivation towards science learning?  
To what extent does the TM-PBL and PBL teaching methods affect motivation towards science learning compared to the Conventional Problem Solving (CPS)? | Student motivation towards science learning.  
Independent variable: 3 teaching methods  
- TM-PBL (treatment 1)  
- PBL (treatment 2)  
- CPS (control group)  
Motivation factors: (dependent variables)  
- Self-efficacy  
- Active learning strategies  
- Science learning value  
- Performance goal | Quasi-Experimental/Pretest/posttest, Experimental/Control Group  
E  
Students use Thinking Maps (TM) as a strategy to foster motivation in all motivational factors compared to control group.  
The more explicit teaching is about thinking and for thinking, the more substantial the impact it has on students’ motivation towards science learning.  
PBL is not sufficient in promoting motivation in self-efficacy, achievement goal, and learning environment stimulation. |
<table>
<thead>
<tr>
<th>Study</th>
<th>Purpose</th>
<th>Definition cited</th>
<th>Method</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stepien &amp; Gallagher (1993)</td>
<td>Problem-based learning turns instruction topsy-turvy. Students meet an ill-structured problem before they receive any instruction. In PBL, students assume the role of scientists, historians, doctors, or others who have a real stake in the proposed problem. Teachers act as models, thinking aloud with students and practicing behaviors they want their students to use.</td>
<td></td>
<td>Informational/Research</td>
<td>Motivation soars because students are vested in the problem.</td>
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<tr>
<td>Study</td>
<td>Research Question</td>
<td>Methodology</td>
<td>Findings</td>
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<tr>
<td>Strobel, &amp; van Barneveld (2009)</td>
<td>How do differences in the definition and measurement of learning contribute to the inconclusiveness of the different meta-analyses with regard to the effectiveness of PBL? Taking the differences into consideration, what generalizable value statements about the effectiveness of PBL can be made and are supported by the majority of meta-analyses?</td>
<td>Comparing PBL to conventional classrooms. An instructional (and curricular) 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. Traditional learning approach – large-class, instructor-driven, lecture-based within a compartmentalized curriculum. Analyzed eight meta-analyses of PBL – seven focused on medical education, one focused on tertiary education. Results: PBL superior for long-term retention, skill development, and satisfaction. Traditional approaches more effective for short-term retention.</td>
<td>Meta-synthesis of existing Meta-analyses PS Reference base on effectiveness of PBL is rich and strong in the field of medicine. 4 categories: non-performance, non-skill oriented, non-knowledge-based assessment; knowledge assessment; performance or skill-based assessment; mixed knowledge and skill-based assessment. Students and staff indicated greater satisfaction with the PBL approach to learning. Short-term retention of knowledge – traditional approach Long-term retention of knowledge – PBL approach</td>
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<td>Summers &amp; Dickinson (2012)</td>
<td>Would the experimental (PBL) group have higher rates of promotion to the next grade level than the control (traditional) group? Would students in the experimental group have high social studies achievement than the experimental group as measured by standardized assessments? Could a PBL curriculum facilitate the realization of the CCR standards alongside enhancing students’ social studies learning?</td>
<td>Dewey (1916) – <em>Democracy and Education</em> Constructivist theory: Social studies engages real-world ideas that connect with students backgrounds and home lives, while maintaining alignment with national standards.</td>
<td>Longitudinal study (4 years) S High school social studies 1 HS used PBL 1 HS used traditional Higher scores and more positive learning outcomes for students receiving PBL instruction vs traditional instruction. PBL group – higher rates of promotion to next grade; higher achievement on standardized assessment;</td>
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</table>
| Sutton & Knuth (2017) | School-wide investment in PBL to improve student achievement | Concept of PBL grew out of constructivist pedagogy popularized by Dewey (1916) and later was successfully implemented in professional training programs.

In PBL, students learn key content knowledge and cognitive, social-emotional, and democratic skills by solving authentic problems or completing projects that reflect a perceived need in the community.

7 design principles teachers should use when creating/implementing PBL activities: 1) authentic problems 2) authentic assessment 3) culturally relevant and responsive pedagogy 4) expertise 5) collaboration 6) academic discourse 7) student voice and leadership. |
|---|---|---|
| Advanced placement students | PBL vs traditional | Problem- and project- based learning differ in few details:

Problem: students learn essential content while solving a highly complex and ill-defined problem, but the content they learn depends on how they conceptualize the problem and potential solutions.

Project: emphasizes product more than process, and teachers tend to emphasize predetermined content while giving students space and time to creatively apply that content to complete a relevant and authentic project. (p. 66)

“All students – regardless of socioeconomic or linguistic status, or special learning needs – showed the benefits of problem-based learning.” (p. 68)

PBL can have positive effects on students’ social, emotional, and civic development |

| Thomas (2000) | Review of Research on PBL – covers 1) Definition of PBL 2) Underpinnings of PBL research & practice 3) Evaluate research; effectiveness of PBL 4) Role of student characteristics in PBL | PBL projects  
- Are central; Projects are the curriculum.  
- Focus on questions, problems: students encounter (and struggle with) central concepts  
- Involve students in a constructive investigation. If activities of project are not difficult to the student or can be | Review of research.  
Examples throughout review include:  
Surveys/Interviews  
Case Study | Focuses on:  
- Project-based learning  
- Problem-based learning  
- Expeditionary learning  
- Project-based instruction | Provides additional articles of PBL in elementary grades for me to research. |
<table>
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<th></th>
<th>Implementation research: challenges</th>
<th>Intervention research: improving effectiveness</th>
<th>Conclusions</th>
<th>Future directions for PBL research</th>
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</table>
| 5) | carried out with the application of already-learned info/skills, it is not PBL. | • Are student-driven, are not teacher-led, scripted, or packaged. No pre-determined outcome.  
• Are realistic. PBL incorporates real-life challenges | | |
| 6) | | | | |
| 7) | | | | |
| 8) | | | | |

**Tillman (2013)**

Did second grade students who participated in a mathematics based PBL unit report higher levels of engagement compared to students who participated in traditional, teacher directed instruction?

- 60 – 90 minute lesson
- Student engagement survey
- High levels in working with and helping classmates in PBL group;
- Collaboration evident

Research did not yield findings that PBL impacts certain domains of student engagement

2nd/3rd grade math  
- case study **E**  
- Virginia

“The majority of research on PBL has been done in medical school settings, with little done in K-12 populations.”  
Several researchers called for additional studies in these age groups (Gallagher, Hmelo-Silver, Zumbach et al) research on PBL in education is still in early stages.

**Wilder (2015)**

What are limitations of current research studying impact of PBL on student academic achievement in secondary grades and what recommendations can be made for future research?

- In a PBL environment, learning is driven by an authentic, ill-structured problem.  
- Based on constructivist theory: activate prior knowledge and build meaningful connections between new content and existing knowledge.  
- Goals of PBL not limited to content acquisition.

7 studies demonstrated that PBL was significantly more effective in increasing student learning growth than more traditional approaches.  
Teachers with stronger content background and PBL experience had more success

**Wilson (2012)**

Constructivism

- Learning as a process of constructing or making something. People learn by making sense out of the world – make meaning out of what they encounter.  
- Active, on-going meaning-making through authentic engagement.

Basic precepts of constructivism:  
learning is active process of meaning-making gained through experience;  
opportunities arise as people encounter conflict, challenge, or puzzlement;  
social activity involving collaboration;  
reflection, assessment, and feedback
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<th></th>
<th>Benefits: corresponds to how people really learn, better outcomes with higher-order thinking, better integration of affect and emotion, and more relevance to job and out-of-the-classroom performance</th>
<th>through learning; learners take primary responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wirkala &amp; Kuhn (2011)</strong></td>
<td>Comparative study</td>
<td><strong>PBL is a teaching and learning method in which students engage a problem without preparatory study and with knowledge insufficient to solve the problem, requiring that they extend existing knowledge and understanding and apply this enhanced understanding to generating a solution. Problems are “ill-structured” ones that do not have a single, clear-cut or formulaic solution, motivating students to ask questions and to seek additional information. (p.1157)</strong></td>
</tr>
<tr>
<td><strong>Yaqinuddin (2013)</strong></td>
<td>Summarizes recent review on PBL effectiveness: 1 – cognitive basis of PBL 2 - knowledge acquisition through PBL 3 – effects of PBL on clinical competencies</td>
<td><strong>Revolution in medical field – adopting PBL</strong> Deliver knowledge in clinical context; use clinical reasoning skills; use self-directed learning skills; excite intrinsic motivation and inquiry</td>
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**Legend:**
- **PBL** – Problem-based learning; project-based learning
- **TI** – Traditional Instruction
- **E** – Elementary
- **S** – Secondary
- **PS** – Post-secondary

**System for Tracking Sources:**
- **Definitions of PBL**
- **History of PBL**
- **Student Achievement/Classroom Implications**
Appendix B

CITI PROGRAM

Completion Date: 20-Feb-2019
Expiration Date: 19-Feb-2022
Record ID: 30001554

This is to certify that:

Samantha Reed

Has completed the following CITI Program course:

Social & Behavioral Research (Curriculum Group)
Social & Behavioral Research (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Virginia Polytechnic Institute & State University (Virginia Tech)

Verify at www.citiprogram.org/verify?w8e7ed212-022c-46fc-a2f8-cdb000d26ebb5-30601554
Appendix C: Letter to Superintendent Requesting Permission to Conduct Study

Dear Dr. Burnette, Interim Superintendent:

As you are aware, I am a doctoral candidate in the Educational Leadership and Policy Studies program at Virginia Polytechnic Institute and State University. I am working under the direction of Dr. Carol Mullen. I have proposed a research study that, once completed, will become my doctoral dissertation. This letter is to inform you of the purpose of my study and to request your permission to conduct the research study Hillsville Elementary School. I am interested in Hillsville Elementary School because of their implementation of problem-based learning, specifically in grades four and five.

The topic of my dissertation study focuses on problem-based learning and its effectiveness at the elementary level. The information collected in this study may be useful to other elementary educators who wish to implement problem-based learning as an instructional approach to teaching. The study will include information from the perspectives of the teachers support staff who worked in grades four and five during the 2017-2018 and 2018-2019 school years. Existing data from Virginia Department of Education’s School Quality Profile may be used to look at student achievement during the 2017-2018 and 2018-2019 school years. The study will be an in-depth study which includes one-on-one interviews with teachers and support staff, and data analysis. Eight participants will be invited to participate in the study. Interviews will be conducted by a substitute researcher, Mrs. Emily Boyles, fellow Virginia Tech doctoral candidate, and will be digitally recorded. Interviews will take place in a conference room at Hillsville Elementary, will last no longer than 45 minutes, and will be held on a day/time agreed upon by Mrs. Boyles and they interviewee. At no time will their involvement disrupt their daily responsibilities. The research study will conform to the requirements set forth by Virginia Tech IRB (HRPP-Protocol # 20-113). A written report of the study will be provided to you upon completion of the study.

Thank you for your consideration, I look forward to receiving your permission to continue with my study. Should you have any further questions or concerns, please feel free to contact me and I will set up a time to personally meet with you.

Sincerely,
Samantha S. Reed
Principal
Doctoral Candidate, Virginia Tech
ssreed@ccpsd.k12.va.us
Appendix D: Letter to Prospective Interview Participants

Dear ________________________,

I am a doctoral candidate in the Educational Leadership and Policy Studies program at Virginia Tech working under the direction of Dr. Carol Mullen. The topic of my dissertation study focuses on identifying key strategies teachers reported using during the implementation of problem-based learning (PBL) in fourth and fifth grade classrooms during the 2017-2018 and 2018-2019 school years. Furthermore, the study will report what strategies aided in the skill development of the Profile of a Virginia Graduate’s expectations of critical thinking, creativity, communication, collaboration, and citizenship. As a teacher or support staff member in grades four and five during the 2017-2018 and 2018-2019 school years who used PBL, your participation in this study is requested. Your participation in this study will not affect, in any manner, your position as teacher or support staff member at the school in which I serve as principal. Your responses to one interview conducted by a third-party will be kept anonymous. However, due to the involvement of the researcher as school principal, any identifying factors that arise from the interview will be kept confined to the conditions of the research study and will not be considered during any principal/teacher interactions.

I am interested in your experiences as a classroom teacher or support staff member in during the PBL implementation at your school. The research study will conform to the requirements set forth by Virginia Tech IRB. Thank you for your consideration in participating in the study. Please email me at smsvrd@vt.edu if you are willing to participate.

Sincerely,
Samantha S. Reed, Principal
Doctoral Candidate Virginia Tech
ssreed@ccpsd.k12.va.us
smsvard@vt.edu
Appendix E: Interview Questions and Protocol

PBL Interview Questions

The following interview questions will be used in each interview, conducted by a research substitute. Each interview will be digitally recorded by the interviewer and later transcribed to aide in the anonymity of the participants.

Interviewer: Thank you for agreeing to participate in this interview to help the researcher collect information regarding problem-based learning (PBL) instruction during the 2017-2018 and 2018-2019 school years in grades four and five at your school. For the purpose of the study, PBL is defined as a teaching method in which students gain knowledge and skills by working collaboratively to investigate and respond to authentic and engaging questions and problems. I will ask each question as stated. Based upon your responses, follow-up probes may be asked.

1. How would you describe PBL instruction that was used in your classroom?
2. What strategies used in your PBL instruction do you think are important?
3. How have strategies you’ve used helped students develop the following skills?
   a. Critical Thinking
   b. Creativity
   c. Communication
   d. Collaboration
   e. Citizenship
4. Are there specific strategies that contributed to stronger development of any of these skills? Explain.
   a. Critical Thinking
   b. Creativity
   c. Communication
   d. Collaboration
   e. Citizenship
5. Based on your teaching experiences, what are some strengths of using PBL in elementary classrooms?
6. Based on your teaching experiences, what are some concerns or challenges with implementing PBL?
7. Based on your experiences with PBL, have you continued using PBL in your classroom? Why or why not?
8. Is there anything else you would like to add?

Interviewer: Thank you for participating in the interview to help the researcher collect information regarding PBL instruction during the 2017-2018 and 2018-2019 school year in grades four and five at your school. A record of the transcribed interview will be sent to you for verification.
Appendix F: IRB Approval Letter

MEMORANDUM

DATE: February 6, 2020
TO: Carol Ann Mullen, Samantha Marie Reed, Emily Tolley Boyles
FROM: Virginia Tech Institutional Review Board (FWA00000572, expires October 29, 2024)

PROTOCOL TITLE: Key Strategies of Problem-based Learning that Contributed to One Elementary School’s Students’ Expectations of Critical Thinking, Creativity, Communication, Collaboration, and Citz

IRB NUMBER: 20-113

Effective February 6, 2020, the Virginia Tech Human Research Protection Program (HRPP) and Institutional Review Board (IRB) determined that this protocol meets the criteria for exemption from IRB review under 45 CFR 46.104(d) category(ies) 2(ii).

Ongoing IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities impact the exempt determination, please submit a new request to the IRB for a determination.

This exempt determination does not apply to any collaborating institution(s). The Virginia Tech HRPP and IRB cannot provide an exemption that overrides the jurisdiction of a local IRB or other institutional mechanism for determining exemptions.

All investigators (listed above) are required to comply with the researcher requirements outlined at:
https://secure.research.vt.edu/external/irb/responsibilities.htm

(Please review responsibilities before beginning your research.)

PROTOCOL INFORMATION:

Determined As: Exempt, under 45 CFR 46.104(d) category(ies) 2(ii)
Protocol Determination Date: February 6, 2020

ASSOCIATED FUNDING:

The table on the following page indicates whether grant proposals are related to this protocol, and which of the listed proposals, if any, have been compared to this protocol, if required.
Appendix G: Sample of Data Analysis

<table>
<thead>
<tr>
<th>Question</th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
<th>Participant 4</th>
<th>Participant 5</th>
<th>Participant 6</th>
<th>Participant 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>What strategies used in your PBL instruction do you think are important?</td>
<td>Okay, I think just allowing them to open up their mind to a different way of learning. It really makes them stop and have to think about, “Okay, how am I going to build this story?” They really have to pay close details to the story that they read in order to get their picture – or, not picture – but their Lego, I guess – their scenery to look like what they</td>
<td>Like I said in the first question, making sure you’re monitoring those kids with that. I did like how the teachers assigned like in reading they had different topics that they had to do. They really had to go through these questions answering that because I didn’t…Like I said, I was going in as the inclusion teacher. A teacher already had her lesson and I just went in and kinda co-taught. I</td>
<td>Before we would even start, we would do a design sheet or a think sheet. They had to come up – that was the day of basically coming up with: this is what I want to do with this question. You started with some type of question or problem. This is what we’re geared towards, but you never gave them the answer. Very open ended, So, we would start with that and they would have to fill out a design type sheet. It had different areas. This is your problem. This</td>
<td>Introducing the subject, modeling it and then letting them be creative. Use creative ways to find solutions. There’s more than one solution to a problem. Coming up with it and seeing what they come up with because we can even learn from some of the things they’re doing.</td>
<td>Well, again, it goes right back to what we – I have talked with some teachers who are just trepidatious about jumping in or that they get overwhelmed, I think, with this idea of, well, we’ve got this big project and it’s got to be that but in my mind, again, it was the PBL in a lot of ways, for me, is teaching like a little kid to eat vegetables, right? It’s a lot of presentation. It’s a lot of like what you’re kind of giving it with.</td>
<td>Making it more open for communication with kids. They were able to openly express themselves more in a smaller setting. So, we would give them some kind of project to work like a novel. They had to understand what the novel was about. They would have to talk it over with their peers. So, it definitely helped the communication. I had a couple of [inaudible] [00:02:37]. They are very shy. And by the end of the year, with that, as I said, they went on to not only improve on their academics, but...</td>
<td></td>
</tr>
</tbody>
</table>
want it to look like. And even down to the detail of the head of the character and what hat they’re gonna wear just really makes them stop and think and use their imagination, whereas paper/pencil really doesn’t do that.

guess the biggest thing would be the structure, monitoring it. And then really having the kids listen to what is supposed to be done and then have them break out and do there. That’s the only strategy I know going into it.

is how I think I’m going to solve it. These are my five ways I might solve it. These are the materials I think I’m going to need to do the project part of it. These are the things that I need to research.

to do something, then we had to research what they needed, how that we can make sure what we got to them was gonna be used appropriately. We then engaged the whole school in a $0.50 drive because that was the price of water. And then the students had to count the money and then had to clean the money. So, I thought every aspect that was – I thought it was really effective for the kids.

can you repeat that question one more time for me?

their open communication skills with their peers, among their peers and even among the teachers there.