THE STUDY OF PROJECT-BASED LEARNING IN PRESERVICE TEACHERS

by

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A Dissertation Submitted to the Faculty of the

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

2016

THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

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ACKNOWLEDGEMENTS

The success of my dissertation and graduate school career would not have been possible without the contribution of many people. I wish to extend heartfelt thanks to those who provided me guidance and support on this journey. My deepest gratitude is to Dr. Heidi Burross; I am privileged to have you as my advisor and the completion of my dissertation would not have been possible without your encouragement, practical counsel, and resolute dedication.

My committee members, Dr. Ronald Marx and Dr. Elizabeth Freiberg, deserve recognition for their knowledge and leadership in helping me expand my research perspectives. Dr. Marx provided insights and constructive criticisms which helped me identify my focus and Dr. Freiberg interacted with me throughout my research, helping me to develop my thoughts and ideas. Thank you both for your invaluable feedback.

I wish to acknowledge the Department of Educational Psychology for their continuous assistance and funding throughout this process.

I am also grateful for my close colleagues, Ganna Sobolevs'ka and Bernadette Mora. You always listened, provided advice, and strengthened my work. I will forever cherish these experiences.

Love to my family for their support throughout my life and and during graduate school. My mother Ann Anderson, whose genuine affection and compassion always reminds me to pursue what I love; my father Mike Anderson, whose determination for achievement encourages me to chase my dreams and aspirations; and my brother Benjamin Anderson, for his humor and kindness, and reminding me that the enjoyment of life's simple pleasures is as important as success and accomplishment.

Lastly, I want to express appreciation to my friends. Paige Weckwerth and Kate Kotzea, you two have been my personal and professional cheerleaders providing moral support from the beginning; Jamie Adams, you have an innate ability to listen and your reassurance helped me overcome the often strenuous academic demands; and Bobby Champlin, who has spent countless hours with me, often at odd hours of the day (and night), when I simply needed a break from writing.

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ABSTRACT

Project-based learning (PBL) is a teaching approach where students engage in the investigation of real-world problems through their inquiries. Studies found considerable support for PBL on student performance and improvement in grades K-12 and at the collegiate level. However, fewer studies have examined the effects of PBL at the collegiate level in comparison to K-12 education. No studies have examined the effects of PBL with preservice teachers taking educational psychology courses. The purpose of this study was to provide an analysis of PBL with preservice teachers taking educational psychology courses. An experiment was conducted throughout two semesters to evaluate student achievement and satisfaction in an undergraduate educational psychology child development course and in an undergraduate educational psychology assessments course, which included the same students from the first semester. Student achievement was determined using quantitative and qualitative analyses in each semester and longitudinally. Results in semester one indicated that the comparison group outperformed the PBL group. Results in semester two suggested there were no differences in instructional styles between groups. Longitudinal analyses showed that the comparison group declined in performance over time, whereas the PBL group improved over time; although, the comparison group still outperformed the PBL group. Results of this study indicate that PBL was not an influential teaching method for preservice teachers taking educational psychology courses.

Keywords: project-based learning, problem-based learning, inquiry-based learning, case-based reasoning, constructivism, social constructivism, preservice teachers

CHAPTER 1: INTRODUCTION

The overall purpose of this dissertation is three-fold. First, I provide an analysis of similar types of inquiry instructional methods compared to project-based learning (PBL) and instruction[1]. Second, I explain PBL design principles and standards that guide student learning. The third goal of this paper is to explain how PBL improves student achievement at the collegiate level, particularly for preservice teachers taking educational psychology classes over the course of two semesters. PBL is a teaching method where students gain knowledge and skills by working on projects (Buck Institute for Education, 2015). Students learn through PBL methods by engaging, investigating, and working on classroom projects while collaborating with their peers and receiving support from the instructor.

Similar types of inquiry instructional methods include case-based reasoning (CBR), inquiry-based learning (IBL), and problem-based learning (PrBL). I examine each instructional approach to explain, clarify, and distinguish the similarities and differences among these varieties of instruction. There have been common misconceptions in the literature regarding the similarities and differences between inquiry approaches to learning. For example, one study by Lee, Blackwell, Drake, and Moran (2014) identified a misconception that studies use PBL and PrBL interchangeably, yet these instructional designs are intended for different and distinct educational environments. Also, Frank, Lavy, and Elata (2003) did not make clear that they were using PBL; instead, they claimed they were using PrBL, but this was an incorrect

[1]Although the term PBL refers to learning, when used in the context of this paper, the reader should understand that it encompasses both learning and instructional components of the entire model.

statement. In this review I discriminate not only PBL from PrBL, but also PBL from CBR and IBL, which may appear to be similar types of instructional approaches.

There are common themes among the instructional methods. These approaches are similar in that they place an emphasis on guiding students through a learning process rather than disseminating information through a traditional lecture-style classroom. According to each instructional approach, disseminating information is not enough for students to learn because students need to learn by doing (Dewey, 1909). In more recent work, Barron et al. (1998) explained that in PBL and PrBL the 'doing' of an activity is important for students to construct an understanding of course content. Colburn (2000) defined IBL as the foundation of a classroom where students engage in student-centered hands-on activities. Schank (1996) showed that through CBR one can learn through acquiring experience, which is a critical element in understanding that one has learned by doing. These approaches also allow students to reflect on their current projects, activities, and overall goals. All frameworks as described throughout this review include open-ended classroom questions and projects, where instructor scaffolding is used to support student learning. Each approach also allows students to prepare for real-world problems by incorporating these problems into the course content and classroom projects.

Using PBL methods, student learning is reinforced and guided through particular design principles. PBL uses social constructivist theories to guide PBL practices. Constructivism is a theoretical view of learning where students acquire deep understanding through experience (Blais, 1988). Social constructivism is a theory of how learning occurs when students construct meaning of their understandings of the world and interactions with other people (Singer, Marx, Krajcik, & Clay Chambers, 2000).

Students construct knowledge by actively learning course concepts. This dissertation examines PBL using the design principles taken from Blumenfeld et al. (1991), Krajcik, Blumenfeld, Marx, and Soloway (1994), and related theories of social constructivism.

Along with an explanation of the similarities and differences among inquiry styles of learning and a description of PBL design principles, my research focuses on the implementation of PBL in studies including preservice teachers. No study focused on implementing PBL for preservice teachers in educational psychology courses, an area worthy of examination. If teachers become cognizant of PBL practices, PBL can help instructors and students find innovative ways of teaching and helping their students learn through hands-on projects. The implementation of PBL allows instructors to break up classroom lecture by allowing students to collaborate with their peers while working on classroom projects. Thus, students' experiences with PBL help them develop the skills necessary to apply PBL to their own future classrooms.

In general, in the literature review presented in Chapter 2, I excluded online and hybrid courses to focus on traditional face-to-face studies because I implemented PBL in a traditional classroom. I only included online or hybrid courses to further explain mechanisms of PBL. The review also generally excluded K-12 education studies because the population of interest here is college students. However, I included K-12 education studies as part of the general review of PBL because most research has documented the effects of PBL in grades K-12 rather than at the collegiate level.

Each approach to learning *appears* to be similar, but there are slight differences in how these types of learning and instructional methods are learned and taught. Specifically, each approach was developed for and works best in differing and particular

fields of study. I describe those fields and associated theories for each instructional approach. Furthermore, I explain PBL design principles in-depth. I also focus on the implementation of PBL in preservice teachers. Though there are very few studies that have documented the effects of PBL at the college level, I predict that PBL methods also benefit those who pursue college degrees, such as preservice teachers.

Research purpose

The purpose of this research was to determine the effectiveness of PBL at the collegiate level, particularly with preservice teachers taking educational psychology courses. Very little research has implemented this learning and instructional method in higher education (Lee et al., 2015). Even less research has focused on PBL experiences including preservice teachers. After an extensive review of the literature, I found five studies that documented college student experiences with PBL. Each study determined that students were satisfied with PBL and that it was an effective method in supporting student learning (Frank & Barzilai, 2004; Hernandez-Ramos, 2007; Land & Greene, 2000; Papastergiou, 2005; Wilhelm, Sherrod, & Walters, 2008). Findings from this research support the efficacy of PBL at the collegiate level. However, none of these studies assessed PBL with preservice teachers taking educational psychology courses. This study examined the relative effectiveness of PBL in two different educational psychology courses over the period of two academic semesters consisting of preservice teachers.

CHAPTER 2: LITERATURE REVIEW

Theoretical Framework

Students learn through an active process of constructing knowledge rather than through passively acquiring knowledge. Constructivist instructional components support student knowledge construction instead of merely communicating knowledge (Cunningham & Duffy, 1996). Frank et al. (2003) defined constructivism as "a theory concerning learning and knowledge which suggests that the human being is an active learner who constructs his/her knowledge on experience and on his/her efforts to give meaning to that experience" (p. 274). This means that students learn, build, and construct knowledge based on their experiences. Social constructivism is a theory of how people learn within a social context (Vygotsky, 1986) by developing an understanding about concepts through interactions with their social world. Singer et al. (2000) explained that this type of learning happens when "students learn concepts or construct meaning about ideas through their interactions with and interpretations of their world, including essential interactions with others" (p. 166).

Theories of constructivism and social constructivism are important for student learning because students need to construct knowledge not merely by absorbing information from the teacher, but through experience and interaction with their instructors, peers, experts in the field, and team members. The goal of applying the social constructivist approach to a learning environment is for students to solve problems that are driven by questions/projects owned by the learner themselves, use experiences to make meaning of these problems, and to learn an active way by doing projects (Jonassen, 1999) through group collaboration. Research has found that by allowing students to

construct their knowledge through working on projects they retain a deeper understanding of content (Sawyer, 2005). The purpose of instruction is for the teacher to be a mentor and/or a mediator to help student learning (Frank & Barzilai, 2004; Frank et al., 2003). Thus, the instructor must create a learning environment that allows students to construct their knowledge through interactions with others and through teacher support and scaffolding.

Theories of social constructivism and PBL compliment each other because students learn to construct their knowledge based on their experiences through social contexts (i.e. group collaboration). Both theories of constructivism and social constructivism are the theoretical basis for each type of learning described throughout this review.

Social constructivist model of teaching. Krajcik, Czerniak, and Berger (1999) provided an explanation for the instructional design principles of a social constructivist model. The initial principle states that students are to engage actively with phenomena. Students engage in phenomena by asking and refining questions (with teachers allowing students to freely ask questions), predicting and explaining phenomena, and interacting with classroom materials. Students then construct knowledge based on these experiences of interacting and engaging with classroom materials. Students are thus better able to retain knowledge through their effort in constructing it (Piaget, 1973).

Additionally, Krajcik et al. (1999) described that teachers and students are to use and apply knowledge by incorporating prior knowledge and classroom experiences. Students must use multiple resources such as books, journals and computers to: illustrate presented information; plan and execute investigations by asking questions and making

observations; apply concepts and learned skills to new situations by connecting old and new ideas; reflect on their questions and scientific hypotheses; and apply knowledge to improve their world by becoming active citizens of society.

The social constructivist model of teaching is characterized by the use of multiple representations for teachers to assess multiple aspects of student understanding of content. Students create artifacts (i.e. understandings of course content) to build and represent an understanding of their knowledge while improving upon these artifacts through teacher-classmate feedback.

Furthermore, steps of the social constructivist principles demonstrate that students must make use of their learning communities (Krajcik et al., 1999). Here, students use language to express their knowledge by talking, debating, and explaining reasons about their ideas, concepts, theories, and evidence through a social context with their teachers and classmates. By sharing their knowledge, students help each other learn new ideas and skills.

Authentic tasks must also be incorporated. Therefore, students must focus on driving questions that support classroom activities and questions that interest the student. Driving questions allow students to connect their ideas, interests, and learning to contexts inside and outside of school. In PBL, the driving questions are what initiates classroom activities.

Case-Based Reasoning

Case-based reasoning (CBR) is a method of solving problems by using students' past experiences (i.e. cases) to solve new problems (Ketler, 1993; Kolodner, 1992). Particularly, students gain knowledge by remembering previous life experiences, which

may suggest that there are solutions to current problems that can help students justify predictions and conclusions to problems. Students may be able to solve problems by adapting previous solutions and interpreting those solutions to examining current, newer, or similar solutions (Kolodner et al., 2003). In a CBR environment, students engage in solving real-world problems and receive real-world feedback from their instructors.

Kolodner et al. (2003) explained that instructors should set up learning environments that help students learn through CBR in five ways. Initially, CBR focuses on the role of failure in promoting learning. Students can produce additional learning goals if they acquire adequate instructor feedback regarding holes in their knowledge. Another focus of CBR is for students to predict and explain phenomena with the help of an instructor. Additionally, because students learn from past experiences, they must focus on indexing (i.e. finding the experience in one's memory) and assessing the application of those experiences to other situations. According to this framework, indexing is important in learning from experience because students have the opportunity to reflect about what they can learn. Learners should apply their ideas to different situations to promote learning. Thus, students are able to learn, interpret, and explain phenomena from a variety of situations to support learning. Additionally, students must be encouraged to reuse their previous experiences in solving problems and use the experiences of other people to solve problems. Within the CBR framework, both teachers and students are held responsible for student learning and knowledge (Kolodner, 1992).

CBR classroom tasks. According to (Kolodner, 1992) students learn through a specific classroom process using the CBR environments that the instructors have set up

for them. This framework states that there must be a description of a problem that reminds students of retrospective cases or experiences, in which instructors must have a lesson plan to give to the problem-solver. The learner must adapt and apply the results from processing previous experiences to new situations. Finally, the learner should generalize the results of their solutions to increase their applicability. The purpose of this process is for students to use results from previous cases and experiences. Students should use other peer experiences to apply learning to new situations. This may increase a student's understanding of a problem.

Kolodner (1992) claimed that these tasks can be applied to and are commonly used in law, with labor mediators, and in auto mechanic classrooms because one must reason with old situations to find and interpret new solutions for a new situation. Aamodt and Plaza (1994) demonstrated that CBR can also be used with physicians, drilling engineers, and financial consultants. Relating previous diagnoses to current diagnoses, avoiding repeated errors, or fulfilling current difficult tasks based on previous experiences allows an individual to solve current problems (Aamodt & Plaza, 1994). Kolodner et al. (2003) also noted that CBR is effective when students design working devices that a professional designer would engage in (e.g. engineer, architect). To do this, the student must understand the task and challenge, generate ideas about the task, learn new concepts to find a solution to the challenge, build and test the device while rethinking and revising the model, and repeat the challenge until a solution is found.

CBR with preservice teachers. In comparison to all other types of approaches to learning I describe below, only two studies evaluated CBR in higher education for preservice teachers. One study by Mostert (2007) identified that preservice teachers may

have challenges in implementing case-based methods into their classrooms because cases may vary in particular situations and preservice teachers possess little experience as compared to professionals. According to the researchers, those using CBR instructional techniques should address all challenges to help prepare preservice teachers use this methodology in their own classrooms. Another study by Florez (2011) investigated undergraduate early childhood preservice teachers who taught using CBR methods. Florez found that students with less prior knowledge gained the most knowledge about children's development.

Inquiry-Based Learning

Inquiry-based learning (IBL) is a teaching method that can enhance student learning outcomes and skills by learning through doing (Spronken-Smith, Bullard, Ray, Roberts, & Keiffer, 2008). Different authors present different definitions of IBL. Spronken-Smith and Walker (2010) described IBL as patchy and challenging to define because there are many diverse terms for IBL. These terms include guided-inquiry, problem-based learning (PrBL), or research-based teaching. However, the notion that IBL is the same as PrBL is incorrect because the classroom tasks and instructional principles between these two types of instruction differ. For example, PrBL approaches implement small-scale projects whereas IBL approaches may include short in-class activities or be incorporated as part of an entire course (Spronken-Smith et al., 2008). Other research has determined that there are also differences regarding the essential components of IBL, where IBL has either been a narrowly defined teaching approach or an approach that may range in additional characteristics (Spronken-Smith et al., 2008). Though there are diverse terms and components of IBL, it is commonly based on the

nature of inquiry, where scaffolding, the building of existing knowledge and new knowledge, and scalability (i.e. the use of IBL within-class or within-course) are important qualifiers of the teaching paradigm (Spronken-Smith & Walker, 2010).

More specific definitions of IBL approaches focus on scientific concepts and content, hypothetical-deductive reasoning, and specific scientific practice that involves critical thinking (Edelson, Gordin, & Pea, 1999; Spronken-Smith et al., 2008). The foundation of IBL includes stimulating curiosity in students (Spronken-Smith et al., 2008) by having students formulate questions, obtain facts, and build knowledge (Oliver, 2001). To support curiosity, instructors or students must stimulate questions and investigative processes to help students build their knowledge (Oliver, 2001). Essentially, IBL is a question-driven and open-ended process where students have to have experience with scientific inquiry but also incorporate personal experience to understand scientific concepts (Edelson et al., 1999). Spronken-Smith et al. (2008) claimed that the aforementioned attributes of IBL are essential characteristics of teaching, although, there are also optional attributes of IBL that include collaborative/group learning, individual learning, university-focused, involvement in the community, field-based activity, resource-based learning, and multi- or inter-disciplinary focus.

IBL classroom tasks. According to Spronken-Smith and Walker (2010), IBL can enhance student learning through five core requirements. Essentially, learning must be stimulated by inquiry, which is driven by questions and problems. Learning is also based on constructing new knowledge and understanding of concepts. To construct new knowledge and understanding students must be proactive in doing or working on projects. Throughout the learning process, students work on projects while teachers

facilitate the projects. This is known as student-centered learning. Finally, students must take increased and self-directed responsibility for their own learning.

Students who learn through IBL may interact with other students by sitting at a large table discussing cases (Magnussen, Ishida, & Itano, 2000). Specifically, medical students would discuss patient cases to determine relevant data about patients while formulating and testing a hypothesis as part of the class. Students may also work in groups to explore the content problem and discuss and question their understanding of the particular content to find an answer to the problem (Spronken-Smith et al., 2008). Clinical faculties (i.e. instructors) would keep students on track by answering questions. After the classroom portion of learning, students move onto the next session of learning by actually working with real patients as part of the IBL project. Spronken-Smith et al. (200) claimed that IBL can also be used from short in-class activities to entire course or degree programs. To assess student understanding of course content, instructors may have students write an essay, take an exam, or give a presentation (Spronken-Smith et al., 2008).

Magnussen et al. (2000) described common fields where IBL is used, such as with medical and nursing students, where students can discuss actual patient cases. In this particular study it was noted that IBL was derived from PrBL because nursing departments wanted to use PrBL for their students and classrooms but found that it was too clinically focused. IBL provided different learning methods than PrBL, which resulted in supporting different learning styles and classroom tasks for students. On the contrary, Spronken-Smith et al. (2008) described PrBL as a form of IBL. Instructional practices do differ in that, unlike PrBL, IBL is sustained for longer periods of time,

focuses on the production of knowledge and not just known answers to problems, and may or may not occur in groups. Spronken-Smith et al. (2008) said that IBL is commonly used in medical training and in geography courses, while Prince and Felder (2006) described IBL as commonly used in the sciences. IBL should not be narrowly defined and may incorporate a range of characteristics that support question-driven learning (Spronken-Smith et al., 2008) in many disciplines.

Learning and instructional similarities and differences. I found no research directly comparing CBR to IBL, but I determined that CBR and IBL do have similarities and differences in their instructional approach. CBR and IBL both use theories of constructivism and social constructivism. In CBR and IBL, students are learning by doing projects while utilizing their classmates to gain new knowledge and ideas. Particular to these two approaches, CBR and IBL emphasize learning by assimilating and accommodating personal experience to understand new concepts. CBR has a particular focus on solving problems by using experiences and adapting them to a new situation. IBL poses specific questions, problems, or scenarios to support student learning.

IBL with preservice teachers. I found two studies that assessed IBL with preservice teachers. One study by Forbes and Davis (2010) had preservice teachers develop classroom curriculum to promote student learning. Preservice teachers adapted science curriculum materials using inquiry-based science lessons. Results revealed that preservice teachers did not actually go through the process of learning through IBL, rather they created curriculum for future students to learn through IBL. The study found that educators designed effective science instructional strategies using IBL. Forbes (2011) engaged students in adapting science curriculum materials using IBL and

teaching. Similar to the previous study, Forbes found that students were able to attend to the principles of IBL for the purpose of engaging their own students in inquiry-based science projects. Again, this study focused on teaching students *how* to implement IBL in a classroom, rather than coaching them using IBL techniques for their own learning.

Problem-Based Learning

Problem-based learning (PrBL) consists of learning and teaching approaches that focus on logical and scientific discovery, particularly discovery by learners. Specifically, PrBL "is the learning that results from the process of working toward the understanding or resolution of a problem" (Barrows & Tamblyn, 1980, p. 1). According to this framework by Barrows and Tamblyn (1980), it is the instructors' responsibility to guide students in regard to what they need to learn at the beginning of a course. The researchers defined this as teacher-based learning. Eventually, students must take over their learning and studies and be held responsible for what it is they need to learn, which is considered self-determined learning. Once students hold themselves responsible for their learning, they must start to identify their own educational needs, identify the best ways to learn, and at what pace they learn best. Thus, students are able to adapt new knowledge to address challenges and problems they face as they work through a problem. Self-determined learning allows students to retain more knowledge because they are more motivated to learn (Barrows & Tamblyn, 1980).

Savery and Duffy (1995) explained that students should work in a complex environment because it provides them the opportunity to reflect on the content learned. Complex learning environment processes consist of teacher support in challenging student learning by creating demanding, opened-ended, and realistic questions. Teachers

allow students to address these problems using real-world settings, where students develop practical solutions to problems (Savery, 2006). Complex working environments allow students to become more realistic problem solvers. Students must also work together in groups to apply their knowledge and skills to the problem or task at hand (Oliver, 2001). As students collaborate, they discover new insights, solutions, and problem-solving skills of course content through peer support (Savery & Duffy, 1995).

PrBL is typically used in medical fields of study (Barrows, 1986; Spronken-Smith et al., 2008). Students are given clinical problems and spend much of their time managing patient cases by solving real-world problems and reflecting on their experiences (Barrows, 1983). Because medical schools put much emphasis on rote memorization (Barrows, 1983), PrBL was created to help students construct applications of course content for themselves through problem solving (Barrows & Tamblyn, 1980). Learning then results from working toward an understanding of clinical problems.

PrBL classroom tasks. Savery and Duffy (1995) described eight principles that guide PrBL. Primarily, classroom activities are anchored to a larger problem. The purpose of learning would be clear in relation to the course problem and project. Learning should then be supported in developing ownership of the problem. Thus, students must be engaged in a project rather than focusing on passing a quiz or test. Furthermore, students design authentic tasks that require thinking and construction of knowledge. In particular, students must engage themselves in tasks that present cognitive challenges. Authentic tasks should be designed in a learning environment that reflect complexity so the learners can seek support in a complex environment. This allows students to reflect their understanding about a particular problem in the field.

Furthermore, students must have ownership of the solution, in which the instructor and learning environment should challenge their thinking rather than dictate their thinking. The instructor should assume the role of a coach or mentor by allowing students to think. Also, instructors should continually encourage testing ideas against alternative views/contexts, which indicates that because knowledge is socially constructed, students should have multiple points of view regarding their topic of study. Last, instructors must provide students the opportunity to reflect on the content learned.

PrBL was first developed in medical schools (Barrows & Tamblyn, 1980), medical fields (Engel, 1991; Kilroy, 2004; Wood, 2003), health, and science programs (Barrows, 1980; Barrows & Tamblyn, 1980; Hung, Jonassen, & Lui, 2008). Other common domains that PrBL is used include training where clinical and field based experiences are incorporated into the course content (Blackbourn et al., 2011), where learning is framed in the context of client problems (Spronken-Smith et al., 2008). PrBL has also been adapted for use in other professions such as legal, business, college, secondary, and primary schools where students work in small groups to learn course content by developing an understanding of how the content is applicable to real-world problems (Siegel, 2012).

Learning and instructional similarities and differences. Case-based reasoning (CBR) is similar to PrBL in that both focus on solving problems by reflecting on student experiences. In contrast, Kolodner et al. (2003) and Kolodner, Hmelo, and Narayanan (1996) emphasized that PrBL probes students to solve problems, reflect on them, and collaborate with other students rather than having the instructor show them how to solve problems. CBR suggests problem solving using the learner's previous experiences or

adapting old solutions to new solutions. PrBL prepares students for clinical practice that involves studying actual situations with learning environments set up so that students can actually interpret those experiences (Kolodner et al., 2003). Like PrBL, CBR also links theory to practice, which is why they are implemented in fields such as law or medicine as mentioned.

IBL is different from PrBL in that IBL uses a greater range of learning methods (Oliver, 2001; Spronken-Smith, 2008). These methods are very broad and may include individual work or multiple collaboration models such as group discussion, lectures or resource sessions, and multimedia type presentations (Magnussen et al., 2010). Because of the greater range of IBL characteristics, Unver and Arabacioglu (2011) explained that there must also be higher levels of instructor scaffolding to support student knowledge construction. High levels of scaffolding are important because IBL involves student production of knowledge without a focus on immediate solutions to the problem, whereas the PrBL method focuses on questions to which the answers are already known (Spronken-Smith, 2008). PrBL also differs from IBL in that PrBL students must become responsible for their own learning after their instructor has guided student curriculum (Barrows & Tamblyn, 1980).

Oliver (2001) described IBL as a "hybrid of problem-based learning with its own idiosyncratic features" (p. 412) because students are required to observe and question explanations, conduct investigations, build models, analyze data and conclude findings, and present their explanations. Other research has determined that PrBL is a component of IBL because IBL incorporates more teaching characteristics than PrBL (Spronken-Smith, 2008). IBL has also been termed PrBL, but is in fact different from PrBL.

Although both IBL and PrBL often focus on patient problems in clinical settings, IBL has less focus on specific clinical problems and more of a focus on theory and the hypothetical-deductive model, which supports multiple collaboration methods that strengthen students' critical thinking (Magnussen et al., 2000).

PrBL with preservice teachers. Aside from use of PrBL in medicine, PrBL has been used in higher education for preservice teachers. Pilgrim (2014) implemented PrBL to teach preservice teachers about PrBL in a mathematics education course. In this study, students had to work towards figuring out problems themselves. Pilgrim found that PrBL was a valuable instructional approach for students. Siegel (2012) applied PrBL to educate preservice science teachers to help students gain insight into useful classroom concepts from the learning sciences so they could learn to apply these concepts to their teaching. PrBL processes redefined the meaning of effective teaching because it offered students the opportunity to build and facilitate knowledge construction of difficult content matter. Blackbourn et al. (2008) executed PrBL in a special education preservice teaching training course where students looked at the use of wireless technologies, such as laptops, to augment PrBL practices. The researchers found that PrBL enhanced student participation with collaboration as a piece of PrBL and increased student satisfaction. Edwards and Hammer (2006) reported on the perceptions that students had while using PrBL. Students said that PrBL helped them bridge theory and practice, supporting that preservice teachers' perceptions and developing skills improved. Chernobilsky, DaCosta, and Hmelo-Silver (2004) looked at how PrBL influenced preservice teachers' language and knowledge development and determined that PrBL

allowed them to structure their ways of knowing. In each of these five studies, PrBL was successful in allowing preservice teachers to develop knowledge and teaching skills.

Project-Based Learning

Project-based learning (PBL), also known as project-based science or project-based instruction, consists of learning and teaching approaches that are student-driven and teacher-facilitated (Bell, 2010; Blumenfeld et al., 1991). Specifically, "project-based learning is a comprehensive approach to classroom teaching and learning that is designed to engage students in investigation of authentic problems" (Blumenfeld et al., 1991, p. 369) that resemble responsibilities professionals execute. Specifically, PBL helps students retain deeper knowledge through the learning process of inquiry. Instructors teach students by engaging them in this process of classroom investigation by doing projects. Instructional components of PBL rely on real-world mechanisms of how students learn in and outside of school, which help students construct knowledge and increase their understanding of how learning happens in different contexts.

The goal of PBL is for learners to develop deeper understandings of content by solving problems through student cooperation (Oliver, 2001), collaboration, the promotion of responsibility and independent learning, and by engaging students in their learning tasks (Frank & Barzilai, 2004). PBL differs from learning through information delivery (i.e. traditional teaching methods) where instructors lecture as a way to disseminate course content. For learners to develop a deeper understanding of course content, teachers and students must overcome instructional challenges to enact PBL and instruction.

According to Thomas (2000), students and teachers encounter challenges using PBL. Students have problems generating scientific questions, managing project time, transforming data, and developing an argument to support their claims. Students also have difficulties being continuously engaged and participative in their inquiries and at times were not able to access the technologies needed to conduct a proper investigation for their projects (Edelson et al., 1999). Teachers also encounter difficulties with managing time because projects take longer than anticipated (Marx et al., 1994). However, the length of projects can be beneficial because projects allow students to construct knowledge through experience and the incorporation of classroom technologies while instructors scaffold to give students adequate help (Marx et al., 1994). Additionally, teachers must address the unique needs of each student, have a level of commitment and desire to allow students to achieve and teach with an in-depth understanding of course content so they can provide affective learning experiences (Tal, Krajcik, & Blumenfeld, 2006).

According to the Buck Institute of Education (2015), the time has come to implement the PBL learning framework in the classroom for particular reasons. One reason to implement PBL in the classroom is because it makes school more engaging. In learning by doing, students are able to be active, rather than passive, in the classroom. This improves student learning and content knowledge because students are able to understand and retain content on a deeper level in comparison to students who learn through traditional teaching methods. PBL allows students to build knowledge, success, and skills in life outside of the classroom (e.g. in practice or careers). Students build confidence in them and their project teams by taking the initiative in working on

classroom projects. Also, because PBL principles emphasize the development of communication, critical thinking, problem solving, collaboration skills, and presentation skills, students are able to develop real-world purposes for their proficiencies. In support, Beckett and Miller (2006) claimed that students improve their collaboration abilities through PBL classrooms.

Furthermore, the Buck Institute of Education (2015) described additional reasons to implement PBL in the classroom. PBL provides students the opportunity to use and familiarize themselves with technology. Technology helps students gain knowledge by using added classroom resources that support student collaboration with experts in the field. PBL connects students with these experts, other schools, and communities. Thus, students are able to make a difference in their own community by addressing real issues and learning to interact with adults and organizations. Classrooms that implement PBL are more enjoyable and rewarding. Instructors are able to engage with and work alongside students in a non-traditional manner.

Student learning. Within the PBL learning context, it is essential that students be cognitively engaged with the subject matter over a prolonged period of time to help them retain a deeper understanding of course content (Blumenfeld et al., 1991). PBL engages students and assumes that students will be interested to test their ideas based on their inquiries. Blumenfeld et al. (1991) claimed that although this component of classroom instruction assumes that students will become motivated to test their ideas, other evidence suggests that students do not typically respond to higher-level cognitive tasks to increase their learning (Meece, Blumenfeld, & Hoyle, 1988) because it is difficult to encourage students to participate in active learning processes (Brophy, 1983).

Although students may be motivated to learn new materials, they do not always use the strategies provided to learn (Blumenfeld et al., 1991), which poses a problem because PBL strategies occur through inquiry, activities, and the construction of problems. However, to encourage student knowledge construction, Blumenfeld et al. (1991) argued that PBL is beneficial and most effective when projects are adequately designed and if teachers can support and scaffold the student learning process.

Instructional support. For students to succeed in the PBL framework, teachers must acquire knowledge and give their students support. Although people may assume that teachers possess all the knowledge needed to effectively support their students, this is untrue because, like students, teachers do not know everything (Blumenfeld et al., 1991). Blumenfeld et al. (1991) provided a good strategy for instructor implementation of PBL, which could help teachers to better assist students. Teachers must examine their own conceptions of learning and instruction. By considering their ideas, teachers can develop instructional strategies to better help their students, understand what their students do or do not know before they start a project, and appropriately implement PBL. Additionally, teachers should not simplify or be imprudent with classroom projects to make instruction easier on themselves. If teachers can avoid this, they can create an environment that promotes inquiry and mastery rather than promoting performance. The second part of this approach includes technologies that support student learning. Teachers may use technologies in their classroom to help motivate and support students to carry out their projects. Technology in learning environments is important for instructional designers to develop theories and guidelines that help facilitate student learning (Beatty, 2002). The Buck Institute of Education (2015) explained that students not only learn to find project

resources using technologies, but also have the ability to collaborate and connect with experts in the field. Technologies may include computational technological tools such as software workshops (Blumenfeld, Fishman, Krajcik, Marx, & Soloway, 2000) or computer-aided design programs that support student learning by helping students find solutions to their inquiries.

PBL classroom tasks. Students go through a process of inquiry to develop questions and solve problems based on their interests. Blumenfeld et al. (1991) explained that in PBL students engage in this process of inquiry by pursuing solutions to problems in the following process:

1. Students must freely ask and refine questions with instructors.
2. Students debate ideas with peers and instructors by explaining reasons about their ideas.
3. Students must make predictions to explain phenomena.
4. Students design plans and/or experiments they can actually carry out and work on in the classroom.
5. Students collect and analyze data and draw conclusions, which helps them create an understanding of the content.
6. Students then draw conclusions about their data to help create meaning of the content.
7. Students need to communicate their ideas and findings to classmates and instructors, which allows them to receive feedback from their instructors and peers.

8. With feedback, students are then able to ask new questions about their inquiries and projects.
9. Last, students are able to create artifacts, or solutions and meaning, about the classroom content.

This framework, according to Blumenfeld et al. (1991), incorporates two components of classroom projects. In the first component, projects require a question or a problem that organizes and drives classroom activities. The results of these activities include the creation of artifacts (i.e. meanings and understandings of the projects and the knowledge accumulated throughout the project). The second component includes driving questions that are created by either the instructor or the student, considering that questions should not be constrained to limit student learning and knowledge. Krajcik et al. (1994) supported this PBL framework and described that student inquiries are formed around a particular driving question, to which students would attempt to find answers. Within this framework, students collaborate with other students, develop artifacts, and use technology to help find answers to their driving questions.

Additionally, PBL principles by Blumenfeld et al. (1991) and Krajcik et al. (1994) emphasize the importance of how driving questions initiate classroom activities. These researchers determine five key features of utilizing driving questions in PBL:

1. The first feature acknowledges that teachers and students should start with a driving question, or a topic to be explored, which includes something students are interested in and can solve.
2. Next, students must explore this question and attempt to find answers through constructing their knowledge and ideas through experience.

3. It then becomes necessary that students and teachers work together to find a solution to their driving question.
4. To find solutions, students are supported and scaffolded through teachers and the use of classroom tools and technology.
5. Last, PBL features highlight the importance that students address their driving questions and findings to the classroom.

PBL promotes active engagement of students over a longer period of time. Typically, these projects are designed for 8-14 weeks of instruction (Frank & Barzilai, 2004; Grant, 2009; Krajcik & Blumenfeld, 2006; Krajcik et al., 1991; Tal et al., 2006). These projects put students in realistic situations as they investigate solutions to problems, which build a bridge between phenomena in the classroom and real-life or real-world experiences (Blumenfeld et al., 1991). Within this context, students include authenticity in their projects that is guided by the driving question and through expressing their interests, particularly something in their personal lives (Buck Institute of Education, 2015). Dewey (1916) similarly argued the idea that student projects and classroom curriculum should include something relevant to students' lives, such as personal experience, to promote engagement.

Blumenfeld et al. (1991) claimed that K-12 educational components of PBL motivate children. From this perspective, children would be interested in testing their ideas based on inquiries and respond to the tasks that increase their learning. Blumenfeld et al. (1991) noted that students will only be interested in testing their ideas through teacher support and scaffolding, which allows students to become cognitively engaged with classroom content. Therefore, it is important that teachers use their knowledge to

scaffold and give support to aid in the success of their students. Teachers can do this by making sure that their content knowledge can help students work through projects while incorporating classroom technologies that will also motivate and support student learning (Blumenfeld et al., 1991).

Educational fields that PBL is most implemented include engineering (Frank & Barzilai, 2006; Frank et al., 2003) and the sciences (Blumenfeld et al., 2000; Krajcik et al., 1994; Larmer, Mergendoller, & Boss, 2015). Each field requires PBL in practice in that students must complete complex tasks based on the driving question(s), design and investigate activities and phenomena bounded by course curriculum, work on the presentation for longer periods of time (i.e. 8-14 weeks), and present their findings to their peers and instructors (Thomas, Michaelson, & Mergendoller, 1999).

Learning and instructional similarities and differences. As noted in this paper, the types of learning described are similar in that they all focus on hands-on learning, learning through experience, and guiding students through a learning process rather than through traditional didactic methods. No literature was found explicitly describing the similarities and differences between case-based reasoning (CBR), inquiry-based learning (IBL), problem-based learning (PrBL), and project-based learning (PBL). However, there are similarities and differences included within each learning and instructional method as described.

For example, a student in a CBR classroom on auto mechanics gains knowledge by solving new ways of fixing a car by recalling previous methods of their mechanical work. In IBL, students gain knowledge by working on and discussing projects in an actual clinical facility using simulated or actual patient cases. In PBL, students build

knowledge by working on projects while responding to complex questions and problems. Also, CBR, IBL, and PBL incorporate learning through collaboration to understand current problems.

In contrast, CBR differs from PBL in that CBR instructors provide students a description of a problem, where learners engage themselves by recalling an old case to solve a current problem. PBL emphasizes the use of driving/guiding questions to engage students throughout the process of the project. The instructor or student can create these driving questions. In comparing IBL to PBL, students work on projects in both learning classes. Within the IBL classroom, students are responsible for self-directing their learning where teachers merely facilitate student projects. In a PBL class, it is essential that teachers support and scaffold student learning, rather than simply assisting them with projects.

Barron et al. (1998) interpreted the similarities and differences between PrBL and PBL. According to the researchers, PrBL and PBL are similar in that they focus on real-world problems or projects. In contrast, PrBL focuses on patient cases, where these real-world problems challenge student learning. PBL uses driving questions to challenge student learning. The Buck Institute of Education (BIE), a reputable company that helps teachers prepare their classrooms using the PBL approach, also explained the differences between PBL and PrBL. Larmer (2013), editor in chief at BIE, described that PBL and PrBL are similar because they both focus on open-ended questions, provide authentic applications of skills, emphasize student inquiry, and are more multifaceted than traditional classroom lessons. The two learning methods differ in that PBL is multi-disciplinary, includes lengthier projects, includes the creation of a project, and involves

real-world authentic tasks and settings. PrBL is more so single-subject, includes shorter projects, includes simple proposed solutions to problems that are typically expressed in oral presentations, and more often uses case studies and fictitious scenarios.

PBL with preservice teachers. A study by Hernandez-Ramos (2007) presented a workshop for preservice teachers using collaborative learning components and technologies aligned with the PBL and instructional models to teach preservice teachers how to develop digital video technologies as a course learning method. From this study, participants were satisfied with learning about digital video for use their classes. Papastergiou (2005) introduced preservice teachers to the design and development of educational websites using PBL. The researcher found that students became confident when creating websites through the use of PBL. Frank and Barzilai (2004) implemented PBL and alternative assessment in a course for preservice teachers and found PBL to be effective for student learning. Land and Greene (2000) asked preservice teachers to develop computer technologies to generate online projects in a PBL environment. Students generated projects and developed knowledge of computer technologies. Wilhelm et al. (2008) introduced preservice teachers to math and science projects that were associated with understanding the moon and sky. Results suggested significant improvements in teachers' understanding of content using PBL. In each of these five studies, PBL either satisfied students or was effective in supporting student learning and understanding of course content.

Concluding Evidence

One study found that students who had less knowledge of a subject gained more than those who had stronger knowledge through case-based reasoning (CBR) methods

(Florez, 2011). In inquiry-based learning (IBL), Magnussen et al. (2000) found that students in low scoring groups showed significant increases in critical-thinking ability. In problem-based learning (PrBL), medical students developed more accurate and coherent problem solving abilities than those who were taught using regular teaching methods (Hmelo, 1998). Research in project-based learning (PBL) indicated that students develop a better understanding of course content and that PBL was more of an effective curriculum compared to traditional classrooms (Blumenfeld et al., 2000; Frank et al., 2003; Marx et al., 2004; Mergendoller, Maxwell, & Bellisimo, 2006; Rivet & Krajcik, 2004; Thomas, 2000). When implemented in higher education, research similarly found that PBL was successful in increasing and supporting student performance (Frank et al., 2003; Helle, Tynjala, & Olkinuora, 2006; Papastergious, 2005). In different studies of each type of learning described in this review, students preferred these different, yet particular types of learning (Frank et al., 2003; Oliver, 2007; Srinivasan, Wilkes, Stevenson, Nguyen, & Slavin, 2007).

In conclusion, each type of learning is driven by a question or larger problem, which guides students throughout their projects and learning process. Clearly, it is important that teachers assist, support, or scaffold their students throughout particular learning processes as previously described, although, it is beneficial to realize that each type of learning has been structured to accommodate students in different fields of study. For example, there are fewer studies using CBR and IBL with preservice teachers because those types of learning are meant for different fields of learning. Although designed for sciences, PBL would most likely better suit the learning and instructional styles for preservice teachers taking educational psychology courses where students have

the opportunity to construct knowledge about teaching by actually developing instruction in the classroom than would PrBL.

Rationale for PBL with Preservice Teachers

PBL methods are heavily implemented in K-12 studies. Blumenfeld et al. (1991) described that PBL influences children's motivation to learn. Since PBL principles have an influence on children's learning, I am generalizing these principles to learning in higher education. The concepts that undergraduate students learn are more advanced compared to K-12 education projects and learning. Although PBL has been successfully applied to K-12 classrooms, I predict that PBL instructional approaches are beneficial for undergraduates and higher-level learning as well.

Very little research has been conducted or documented using PBL in higher education. Research that does exist has found considerable support for the effectiveness of PBL in higher education (Frank & Barzilai, 2004; Frank et al., 2003; Helle et al., 2006). Students who pursued long-term investigations in their classroom projects have developed a better understanding of the course content (Blumenfeld et al., 1991). Studies by Lee et al. (2014) considered the lack of the role PBL plays at the collegiate level, in comparison to K-12, and called for more research on PBL in higher education. Specifically, Lee et al. (2014) argued that "higher education has lagged behind K-12 education in adopting PBL" (p. 21). Pascarella and Terenzini (2005) described that while constructivist approaches to teaching may be common, traditional lecture-style teaching is still the leading instructional method in higher education. Research on PBL at the collegiate level has been limited to the field of engineering (Frank & Barzilai, 2004; Frank et al., 2003; Mills & Treagust, 2003).

After an extensive review of the literature, only five studies were found that implemented PBL in traditional face-to-face classrooms including preservice teachers. In each of these studies, different fields included the use of instructional technologies in the classroom, developing websites, using alternative assessments, developing classroom technologies, and science. None of these studies observed or reported the effects of PBL in an educational psychology course for preservice teachers. Also, because PBL focuses on learning and instruction, it is important to determine which type of effective learning and instruction approaches have on our future teachers. Preservice teachers are learning how to teach and they must be prepared to understand pedagogical practices (Bransford, Darling-Hammond & LePage, 2005). Once they graduate, they are required to design and implement instruction in their classrooms. Furthermore, they may be required to implement innovative instruction in their jobs, where instructors and students focus on active learning by integrating constructivist-based classroom approaches (Coyle, Newman, & Connor, 2015). Preservice teachers may become more attentive to PBL approaches because they have experienced the PBL methodology and know its relevance later on in their professional practices. Therefore, the purpose of this study is to determine the effects and student satisfaction of PBL in two educational psychology courses involving preservice teachers.

Guiding Research Questions

The purpose of this study is to investigate the effects of PBL during two academic semesters. First, this study investigates and determines the effectiveness of PBL by analyzing student achievement. Specifically, project grades, midterm and final examination grades, and participation grades were measured. Second, this study

investigates and determines student satisfaction with PBL in the classroom. According to Green (1998), students who learn through projects increase their motivation to learn; therefore, students become satisfied with learning through projects. Frank et al. (2003) found that students thought PBL was advantageous because they were exposed to skills they would need to have as a professional. Thus, the research questions include:

- **Research Question 1 (RQ1):** Does PBL improve student achievement in two different semesters and longitudinally?
- **Research Question 2 (RQ2):** Are students satisfied with PBL?

I predict that PBL has a positive effect on student achievement and student satisfaction in the first semester, second semester, and longitudinally (i.e. from semester one to semester two). Understanding the relevance of this research is important for two reasons. Primarily, no studies have implemented PBL in educational psychology courses including preservice teachers. Thus, this research is intended to help instructors implement and improve in their instructional practices in educational psychology courses. Second, if instructors learn to apply and improve their classroom practices using the PBL framework, this will in turn benefit student achievement and instructional satisfaction.

CHAPTER 3: METHOD

Participants

The data for this study were collected from a sample of 37 undergraduate students who attended a Southwest university over the course of two academic semesters. I recruited both male and female participants, ages 18 years and older. Ethnicity was not measured. Of the students who chose to participate, 33 of them were female and four of them were male. Only students who consented to be part of this research participated in this study. I sought to recruit a total of 50-60 participants, however, classroom enrollment was lower than estimated. I also recruited a willing instructor who taught each course (i.e. the comparison and PBL classrooms) assessed in this study.

Materials

Project materials[2]. Student projects (Appendix A-D) in semester one required the evaluation of an actual elementary school student with whom they choose to work with throughout the entire semester. These projects allowed the students to become more exposed to working with children as compared to a traditional elementary education sequence where they would first take classes as part of the program and then student teach. A benefit to this approach is that students applied theories learned in lecture to an actual K-6 classroom as part of their teacher training.

Projects (Appendix E-H) in semester two required students to actually create classroom instruction by developing course outlines and instructional objectives, summative and formative assessments, and a performance assessment and scoring rubrics. All projects allowed students to build their knowledge and work experience in

[2] Each project was revised from past use for the purpose of this instructional intervention by the current instructor of the course.

the classroom by actually creating and developing instruction—something students will do once they begin their profession.

Instructional intervention design principles. PBL principles taken from Blumenfeld et al. (1991) and Krajcik et al. (1994) were used for this study. Projects are also linked to professional teaching standards taken from the Interstate Teacher Assessment and Support Consortium (InTASC), International Society for Technology Education (ISTE), Arizona Professional Teaching Standards, and the teaching standards of the university where the study took place.

Standards encompass preservice teacher program learning requirements and incorporate teaching ideals that new skillful and knowledgeable educators must possess. InTASC incorporates teaching standards that educators must possess to ensure students learn new knowledge and skills, to ensure teachers are knowledgeable and have a flexible understanding of course content, to assure teachers integrate assessment that ties back to their class goals and objectives, and that teachers support productive learning environments (CCSSO, 2011). ISTE (2016) teaching standards describe that to aid student success, teachers must inspire student learning and creativity, develop digital learning experiences and assessments, and model digital work and learning. State professional teaching standards mandate that teachers must support the development and implementation of K-12 education by including academic standards in language arts, literacy, mathematics, science, social studies, and educational technologies in their classrooms (Arizona Department of Education, 2016). University criteria also incorporate teaching standards new teachers must possess that include preservice teachers' knowledge of all InTASC and ISTE standards.

All teaching standards represent PBL methods in that PBL connects students to real-world communities (Buck Institute of Education, 2015) and professional standards.

Measures

Grading rubrics. As part of an instructional intervention by Frank and Barzilai (2004), PBL was implemented in a required methods course for preservice teachers. According to Frank and Barzilai (2004), education traditionally assesses through paper and pencil tests, where a student grade is often based on unidimensional performance, which may poorly measure student application of knowledge. Their study used formative assessment through PBL to raise standards of achievement. Specifically, student performance was assessed through student-teacher meetings, observations of the students' work, group reports, personal reflective reports, and presentation of artifacts created. Frank and Barzilai (2004) addressed a claim by Krajcik et al. (1999) that this type of alternative assessment is reliable, valid, and more consistent with measuring and helping students integrate a deeper understanding of content and knowledge. Though this claim was made, I was not able to scientifically verify the accuracy of this alternative assessment.

The assessment approach used by Frank and Barzilai (2004) was applied to this instructional intervention and relates to PBL in multiple ways. Primarily, the instructor focused on the entire learning process, where students were able to build knowledge and become experts through doing and revising projects, rather than solely focusing on final results or pencil-to-paper tests. The instructor evaluated students based on interactions with and observations of student/project progress. Also, the instructor variously assessed student progress not only through project progress, but also student presentations,

participation assignments, and examinations. Throughout both semesters, the instructor allowed students to self-reflect and self-regulate as learners by engaging students in self-reflection of their own learning as part of project requirements or in-class discussion. Frank and Barzilai also recommended that instructors focus on individual student performance and improvement, rather than comparing student to student. The instructor did this through observing, supporting, and scaffolding student learning. Assessment rubrics (Appendix I-S) included quantitative and qualitative assessment measures.

Assessment scoring. Student achievement was measured based on student project scores, examination scores, and participation scores in each semester and longitudinally. In semester one, projects were scored out of 100 points; examinations out of 92 points; and participation grades out of 50 points. In semester two, projects were assessed out of 150 points; examinations out of 88 points; and participation grades out of 60 points.

Survey. In the first semester, I designed a PBL instructional and curriculum satisfaction survey that PBL students took at the end of the semester (Appendix T). The survey included 15 closed-ended and two open-ended questions that allowed students to share their satisfaction with PBL. The closed-ended satisfaction survey questions used a 7-point Likert-type scale that asked participants to rate their level of satisfaction. The survey was found to have good internal consistency ($\alpha = .91$).

I redesigned the survey implemented in semester one for semester two (Appendix U). This survey included a revised version of similar 15 close-ended questions and two open-ended questions, which allowed PBL and comparison group students to conclude their satisfaction with the course instructional methods and curriculum. The survey was revised to incorporate questions asked in the first person with the expectation that

questions were more personable for students to answer and better understand. Also, I revised the survey by taking out PBL identifiers. Thus, it could be implemented between both groups so I could evaluate if the comparison group felt like they were in a PBL classroom. Unlike the previous survey, this survey used a 5-point Likert-type scale where students rated their level of satisfaction. I used a 5-point Likert-type scale to give students fewer items to choose from, taking into consideration a 7-point Likert-type scale may have been too copious for them. The survey increased in internal consistency from semester one to semester two (α= .95).

In the quantitative portion of each survey (Appendix T-U), questions 1-5 consisted of design principles taken from Blumenfeld et al. (1991) and Krajcik et al. (1994). The purpose of including these principles was for students to evaluate instruction and learning based on the PBL and instructional intervention and design. Question six was adapted from Blumenfeld et al. (1991) on using PBL in the classroom for student motivation. Here, students answered based on how they felt PBL motivated their learning. Survey questions 7-9 were taken from Gülbahar and Tinmaz (2006). These questions gave students the opportunity to respond if classroom materials were appropriate for students to construct knowledge, if the instructor encouraged student learning, and if the course materials and activities (projects) encouraged student learning. I designed questions 10-15 and two open-ended questions. The purpose of questions 10-15 were for students to respond with how well the instructor supported learning, how well students learned through collaboration, if PBL was helpful for student learning, if the instructor generally implemented PBL well, if the course content was well designed, and if PBL was helpful for students preparing to become teachers. Open-ended questions

allowed students to include additional comments regarding instructional and curriculum satisfaction throughout the PBL semester. These questions confirmed student satisfaction with PBL.

Research observation protocol. I designed an observation protocol (Appendix V) to guide and measure classroom observations. Following this protocol enabled me to ensure that the instructor and students were adhering to PBL approaches. I measured my observations by following PBL design principles by Blumenfeld et al. (1991) and Krajcik et al. (1994), guiding questions I created to ensure the instructor followed through with PBL instructional methods, overall notes to summarize my observations and how they aligned with PBL methods, and a notes section for the PBL group and the comparison group so I could clearly refer back to my observations.

Instructor interview protocol. An interview procedure (Appendix W) was designed in order to ensure that the instructor and I agreed on my PBL observations. I took notes of the observations made during class and sent those notes to the instructor. In turn, I asked the instructor to respond to ensure she was satisfied with the validity of the observations. The instructor was also able to evaluate the classroom approach to teaching.

Procedure

Design. The research design that was used in this study relies on the collection of quantitative, qualitative, and design-based research (DBR). DBR embraces instructional and classroom interventions that allow students to take charge of their own learning (Brown, 1992). Researchers can study how students learn in real-life contexts rather than in lab-like settings (Brown, 1992). Furthermore, DBR includes a series of approaches

(Barab & Squire, 2004) that are theoretically framed, include empirical research of learning and teaching based on particular instructional approaches, and pursues goals in developing effective learning environments while using those environments as a place to study learning and teaching (Sandoval & Bell, 2004). Barab and Squire (2004) explained that DBR focuses on learning and teaching in naturalistic settings (i.e. real-world classroom practices) and are iterative (Joseph, 2004). DBR is appropriate for PBL approaches as a course instructional design and intervention. During implementation, students learn by working on real-world projects by continually creating and testing prototypes while improving on their design (Anderson & Shattuck, 2012). In each semester, the instructor had the opportunity to improve upon instruction, while students had the opportunity to improve on their project designs.

The independent variables in this research include PBL and instruction and the dependent variables include student performance of the project grades, examination grades, participation grades, and student satisfaction. Quantitative data included student project grades, examination grades, participation grades, and a student satisfaction survey. The survey included closed-ended questions that were quantifiable. Qualitative data included the instructional components of PBL. One component incorporated student satisfaction of the PBL method. Here, students had the opportunity to critique the instructor and course curriculum in their own words. Another component contained observations of the instructor's teaching style to ensure the instructor was implementing the PBL method with fidelity.

Analysis. For RQ1, quantitative data were analyzed using a one-way multivariate analysis (MANOVA). One-way MANOVA was used for data analysis because this

study looked at the instructional differences among learning groups on related dependent variables (Pallant, 2013; Tabachnick & Fidell, 2012). To measure student achievement longitudinally over two time points, I analyzed data using a repeated-measures MANOVA (Tabachnick & Fidell, 2012). Data from classroom instructional observations and researcher-instructor interviews were qualitatively analyzed to ensure that the instructor had the same impressions of my observations.

For RQ2, quantitative data were analyzed using descriptive and inferential statistics. Data were gathered using the open-ended questions included as part of the student satisfaction survey. These data were analyzed qualitatively by compiling student responses and documenting all supporting conclusions regarding students' thoughts about PBL.

Study process. One instructor taught two different educational psychology courses in two different semesters from which I recruited a total of 37 of 39 possible participants. I followed the same students from semester one to semester two. In the first semester I observed two educational psychology child development courses; in the second semester I observed two educational psychology assessment courses. Groups were randomly assigned to either a PBL or comparison group classroom before this study; although, students within each group (i.e. classroom) already existed. In each semester, one course was taught using PBL methods and was considered the PBL group. The other course was taught using the instructor's traditional teaching method and was considered the comparison group. From semester one to semester two, each class remained intact; therefore, I could measure student achievement longitudinally.

Semester one. I was unable to observe the first three classes. During this time, student projects had not started. Thus, I was only unable to observe the instructor's PBL teaching applications. Starting the fourth class, I was able to observe both classes and consult with the instructor regarding the study and classroom projects. The purpose of this consultation allowed the instructor and I to organize classroom activities that incorporated PBL projects, goals, and deadlines; to discuss the PBL design principles had to be followed; and to answer any questions or concerns the instructor had regarding the process. The instructor had never taught a class using PBL methods before this experiment.

At the beginning of the fourth class I recruited participants and began to attend the PBL and comparison group classes. Each class was scheduled one day per week. The PBL course occurred from 8:00-10:45 in the morning and the comparison course took place from 1:00-3:45 in the afternoon on the same day. For observation purposes, I attended all PBL classes with the exception of the first three classes as described and two examination days. In the comparison classroom I attended various classes. The purpose of all observations was to assure the instructor was either adhering to PBL instructional classroom principles or traditional teaching methods, to observe student learning and collaboration in progress, and to assess student projects. At the end of the semester I administered a student satisfaction survey to the PBL group before students gave their final project presentations as per the instructor's recommendation.

Semester two. Before the semester started, I consulted with the instructor regarding the classroom projects. Again, the consultation allowed the instructor and I to

organize course curriculum to incorporate PBL approaches. By this point in the study, the instructor had experience teaching one class using the PBL framework.

I followed the same students from semester one to semester two. No students dropped out of the study. Similar to semester one, each class was scheduled one day per week. The PBL course occurred from 11:30-1:15 in the afternoon and the comparison course took place from 8:00-10:45 in the morning. I observed all except four PBL classes (two examination days and two unplanned days). I was only able to attend one comparison group classroom because it interfered with my teaching schedule. Thus, I had to rely on the instructor's feedback when comparing groups. Again, the purpose of my observations was to ensure the instructor was following PBL instructional principles, to observe student learning and collaboration, and to assess student projects. At the end of the semester, I administered the student satisfaction survey to the PBL and comparison group.

Curriculum. In semester one, I observed a child development course, where human growth and development from conception through early adolescence was taught. This course integrated behavioral principles into an elementary school setting and was a theoretically based course. In relation to PBL projects, students applied theory to actual human development. PBL projects included a paper/observation plan, projects, and a presentation. Before students began their projects, they developed an observation plan (Appendix A) where they gathered specific information about who they chose to observe throughout the entirety of the semester. Project one (Appendix B) included observations of physical development; project two (Appendix C) included observations of cognitive development; and project three (Appendix D) included observations of social-emotional

development. The final project (Appendix D) included a revised compilation of projects one through three and also consisted of student presentations of their observation findings.

In semester two, I observed a psychological measurement in education course, where the instructor taught how psychometric methods were applied to assessment, which included ethical implications of testing, test design, traditional and performance-based tests, diagnostics, automation in testing, standardized testing, and grading processes. This course was less theoretically based than the child development course. Both classes were educational psychology courses, but included different content (i.e. theoretically based versus applied). In relation to PBL projects, this class focused more on the application of psychological measurement within a classroom setting. PBL projects consisted of students designing classroom instruction. The purpose of project one (Appendix E) was for students to create instructional objectives, build content outline for an instructional unit, and determine state standards for learning and instruction. In project two (Appendix F), students wrote test items that aligned with project one instructional objectives. For project three (Appendix G), students created performance assessment and appropriate scoring criteria in relation to the instructional objectives created in project one. The final benchmark project (Appendix H) assessed students' understanding and application of skills required for writing assessment material. Specifically, this assignment included revised submissions of assignment one through three, where they had the opportunity to improve based on the instructor's feedback before submitting a final copy of their semester-long projects. At the end of the semester, students discussed their project findings with their peers and instructor during class.

PBL group projects followed instructional design principles formed by Blumenfeld et al. (1991) and Krajcik et al. (1994), where students were able to explore content through observation (semester one) or through creating instruction (semester two). The instructor acknowledged driving questions for each plan and project. Students also explored each driving question through projects by constructing their own knowledge, through experience, and while working with the instructor to find solutions to their questions. Once students identified and explored the driving question(s), their instructor supported students by allowing them to ask questions while using tools and technologies the instructor recommended (i.e. journal articles, online resources) to assist in their knowledge construction. Last, students readdressed their driving questions by presenting their findings to their instructor and peers.

Students in the comparison group completed the same projects as did those in the PBL group. One reason for this is that (even though there were two different class times), the classes shared the same university student/course website where they gathered shared course curriculum materials and viewed their grades. Though course projects were the same in both groups, the instructor tried to make the instruction as distinct as possible. For the comparison group projects, the instructor did not acknowledge driving questions to initiate project activities, so students did not have the ability to explore and attempt to find answers through these questions. The driving questions were not part of the project requirements. Students in the comparison group did not collaborate to discuss their projects, but were supported and scaffolded by their instructor and through the use of classroom tools/technologies (i.e. class readings). At the end of the semester,

comparison group students presented their projects to their peers and instructor, but did not address their initial driving question findings that are used to initiate PBL activities.

Students in both groups completed participation assignments throughout both semesters. Participation assignment activities were completed by students in class, individually to then be discussed in class, or in their K-6 cooperating classroom. Students then discussed these assignments during class. The purpose of these assignments was for students to participate and collaborate actively with peers during class while discussing course content. Participation assignments in the PBL groups aligned with PBL methods by Blumenfeld et al. (1991) and Krajcik et al. (1994) in that students explored the particular participation topic, attempted to find answers to the material, collaborated with their instructor and peers to find solutions to the topic, used curriculum (i.e. assigned participation readings and course materials) to support their learning that was provided by the instructor, and presented their answers to the entire class and instructor. In the comparison groups, the instructor deviated from PBL methods and focused less on group collaboration by not leading students to discuss activities with each other. Both groups took midterm and final tests in class. Material on the examinations came from lecture and readings. At the end of each semester, I administered the student satisfaction survey.

PBL group. In both semesters, the classroom was set up where students in the PBL group sat around tables in groups of approximately 2-6 students. During group collaboration, this was beneficial as students were already gathered for discussion. The class had internet access and students were able to use online tools to support their learning. However, the internet signal was weak, and students were not always able to

gain online access. This was unfortunate and disadvantageous when students could have used online resources and tools to support their knowledge construction.

In general, the instructor usually lectured during half of the class and spent the other half of the class engaging students in group discussion and collaboration in both semesters. Lecture and group collaboration was broken up into portions throughout the duration of the class. Typically, the instructor started each class reviewing previous content to ensure all students understood previously taught concepts. The instructor also focused on the assignments for the purpose of answering student questions about the projects. Project driving questions were also addressed during these reviews; although, students did not typically engage in or have many questions regarding the projects. However, the instructor let students discuss their current findings with peers in each semester. This allowed students the opportunity to understand their current findings. After the content and project review, classroom activities included lecture, peer-to-peer, group, and classroom collaboration and discussion of content.

In addition to in-class group discussion and collaboration of course concepts and project ideas, students also worked on in-class participation assignments prompted by the instructor. The purpose of these assignments was to engage students in the course content. As students fulfilled these assignments, the instructor joined in discussion with each group of students and answered any questions to assure students were on task. During discussion, the instructor continued to engage those students in the task at hand by discussing content with each group. Once students appeared to have constructed an understanding of the content, the instructor would prompt an entire group conversation of the topics.

Comparison group. The instructor attempted to lecture most of the class, but because class periods were so long the instructor would implement small class discussion to informally check students' understanding of the content. Similar to the PBL class, students also sat around tables in groups of approximately 3-6 students in each semester. Although this seating arrangement was not intentional, it did allow students to collaborate as they were seated in a manner where group discussion was inevitable. In this class, students had a poorer connection to the internet than did the PBL class. The instructor brought a wireless internet device to class that students could use if needed. However, the instructor did not explicitly suggest that students use online sources (i.e. outside sources) that support their learning because this class included traditional teaching methods, where these tools are not required for student learning.

Similar to the PBL group, the instructor usually started class by reviewing previously taught concepts to ensure all students made sense of content learned in previous classes. The instructor also addressed student projects but did not address the driving questions that were intended to lead student knowledge construction in a PBL environment. Throughout the class, the instructor did not prompt or try to engage students in group discussion or collaboration.

Course groups included a close cohort of students that followed each other from the child development course to the assessments course. Students in the comparison group were particularly close-knit.

Instruction. Collins, Joseph, and Bielaczyc (2004) explained DBR characteristics, in that instructional/classroom design should constantly be revised based on experiences. In this study, the instruction changed from semester one to semester two

to improve upon the PBL method. To improve upon semester one PBL processes, driving questions were strengthened in semester two to initiate more teacher based inquiry, rather than general inquiry, considering I researched the effects of PBL in preservice teachers. In semester two, the instructor implemented more hands-on activities in the PBL group. Thus, students spent more than half of their time in class not only discussing course content, but actually working on activities to help them construct knowledge of the content. The instructor also provided examples of each project in semester two to help students construct an understanding of what they needed to do when creating instruction. Project examples allowed the instructor more opportunities to scaffold student learning.

CHAPTER 4: RESULTS

RQ1

Quantitative results. In both semesters, data were analyzed using a one-way MANOVA. There was a statistically significant difference between PBL and comparison group instructional methods in semester one on the combined dependent variables, $F(3,33) = 5.78$, $p = .01$, $\eta^2 = .35$. To account for an unequal sample sizes, Pillai's Trace was used for effect size, with a large partial eta squared of .35 (Cohen, 1988). An independent samples t-test was conducted to compare project, examination, and participation scores to the instructional style. There was a significant difference in project scores, $t(35) = 2.26$, $p = .03$ (two-tailed); a nonsignificant difference in examination scores, $t(35) = 1.81$, $p = .08$ (two-tailed); and a significant difference in participation scores, $t(35) = 2.52$, $p = .02$ (two-tailed). The comparison group did significantly better than the PBL group.

In semester two, there was not a statistically significant difference between PBL and comparison group instructional methods on the combined dependent variables, $F(3,33) = .71$, $p = .44$, $\eta^2 = .06$. However, I was able to measure pre- to post-test scores for each group. To measure pre- to post-test achievement, I conducted a repeated-measures MANOVA (Tabachnick & Fidell, 2012). Using Pillai's trace, between-subjects effects were significant for the mean differences between instruction type from pre- to post-test, $V = .83$, $F(1,35) = 170.40$, $p = .01$. The comparison group did significantly better than the PBL group. Students did not perform differently from the beginning to the end of the semester regardless of instruction type, $V = .01$, $F(1,35) = .38$, $p = .54$.

In both semesters, the comparison group outperformed the PBL group in all areas except for participation in the first semester. Descriptive statistics of the means and standard deviations of each treatment group and assignment are presented in Table 1 (semester one) and 2 (semester two). Tables include the mean, standard deviation (SD), and the number of participants in each group (N).

TABLE 1

Semester 1: Means and Standard Deviations by Groups

	Group	Mean	SD	N
Projects	PBL	93.84	3.86	19
	Comparison	96.76	4.02	18
Exams	PBL	81.63	7.98	19
	Comparison	85.67	5.19	18
Participation	PBL	47.26	4.15	19
	Comparison	43.50	4.94	18

Note: PBL = Project-Based Learning Group

TABLE 2

Semester 2: Means and Standard Deviations by Groups

	Group	Mean	SD	N
Projects	PBL	142.88	5.89	19
	Comparison	144.44	4.84	18
Exams	PBL	78.5	6.00	19
	Comparison	80.58	5.59	18
Participation	PBL	58.00	6.83	19
	Comparison	60.00	0.00	18

Note: PBL = Project-Based Learning Group

To measure student achievement longitudinally, I converted all scores between semesters into percentages for consistent comparisons across semesters because point values differed. To analyze achievement over time (i.e. from semester one to two), I conducted a repeated-measures MANOVA (Tabachnick & Fidell, 2012). Using Pillai's trace, between-subjects effects were significant for mean differences between instruction types over the two semesters, $V = .22$, $F(3,33) = 3.09$, $p = .04$, $\eta^2 = .22$. Students performed differently across semesters regardless of instruction type, $V = .30$, $F(3,33) = 4.60$, $p = .003$, $\eta^2 = .33$. Within-subjects effects were also significant across the interaction in change of student performance over time, $V = .22$, $F(3,33) = 2.95$, $p = .01$, $\eta^2 = .30$. Figures of the interactions of each treatment group and assignments (except for participation grades as explained below) are presented in Figure 1 and 2.

Tests of between-subjects effects indicate that all projects were not significantly different from each group, $F(1, 35) = 72.75$, $p = .06$; exams were not significantly

different from each group, $F(1, 35) = 210.78$, $p = .11$; and participation grades were not measured due to little variability in scores. Univariate one-way ANOVAs did not indicate a statistically significant difference in projects [$F(1,35) = 4.10$, $p = .53$, $\eta^2 = .01$] and exams [$F(1,35) = .25$, $p = .62$, $\eta^2 = .01$].

Across semesters, the comparison group outperformed the PBL group in all areas except for participation in the first semester. Descriptive statistics of the means and standard deviations of each instructional group and assignment are presented in Table 3. Tables include the mean, standard deviation (SD), and the number of participants in each group (N).

TABLE 3

Semester 1 & 2: Means and Standard Deviations by Groups

	Group	Mean	SD	N
S1-Projects	PBL	93.84	3.86	19
	Comparison	96.76	4.02	18
S2-Projects	PBL	95.25	3.92	19
	Comparison	96.29	3.23	18
S1-Exams	PBL	88.73	8.67	19
	Comparison	93.12	5.64	18
S2-Exams	PBL	89.21	6.82	19
	Comparison	91.57	6.35	18
S1-Participation	PBL	94.53	8.30	19
	Comparison	87.00	9.88	18
S2-Participation	PBL	96.67	11.39	19
	Comparison	100.00	.00	18

Note: PBL = Project-Based Learning Group; S1 = Semester one; S2 = Semester two

FIGURE 1

Estimated Marginal Means of Projects

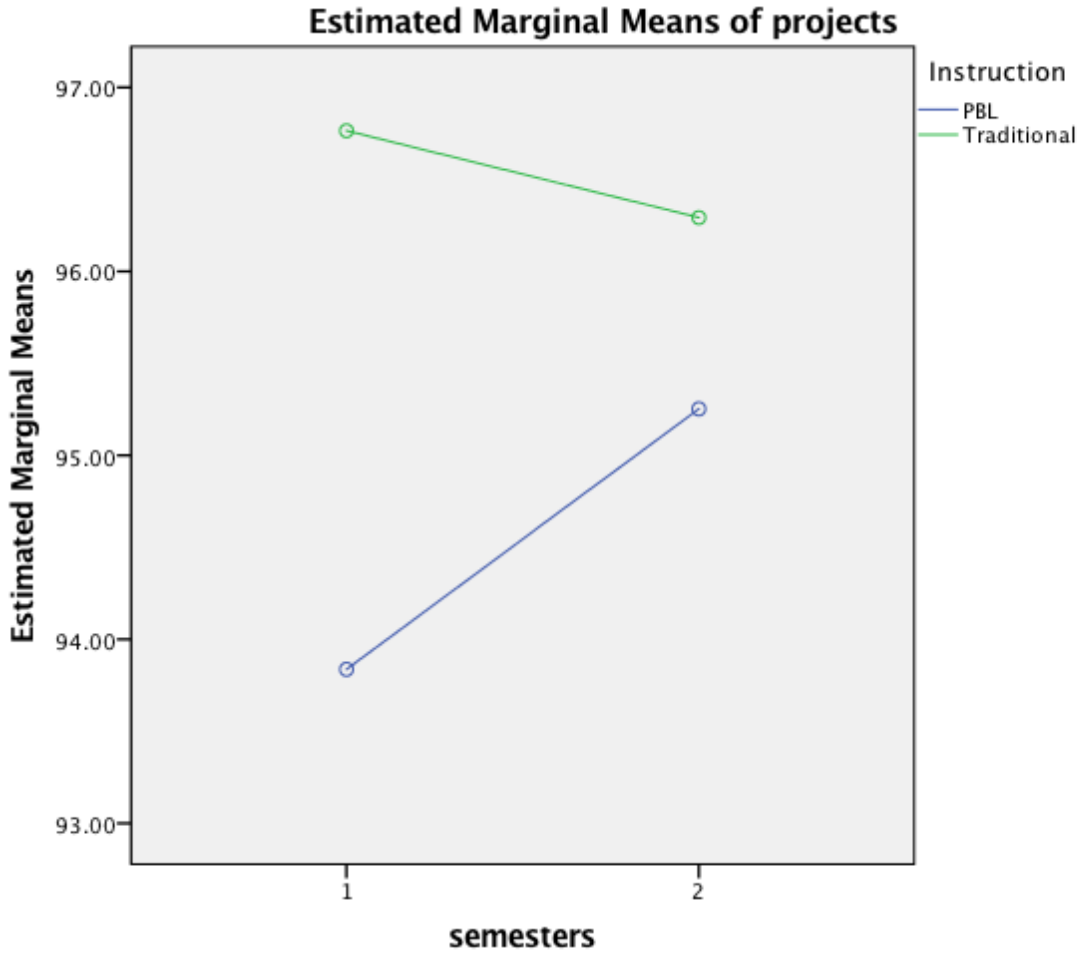
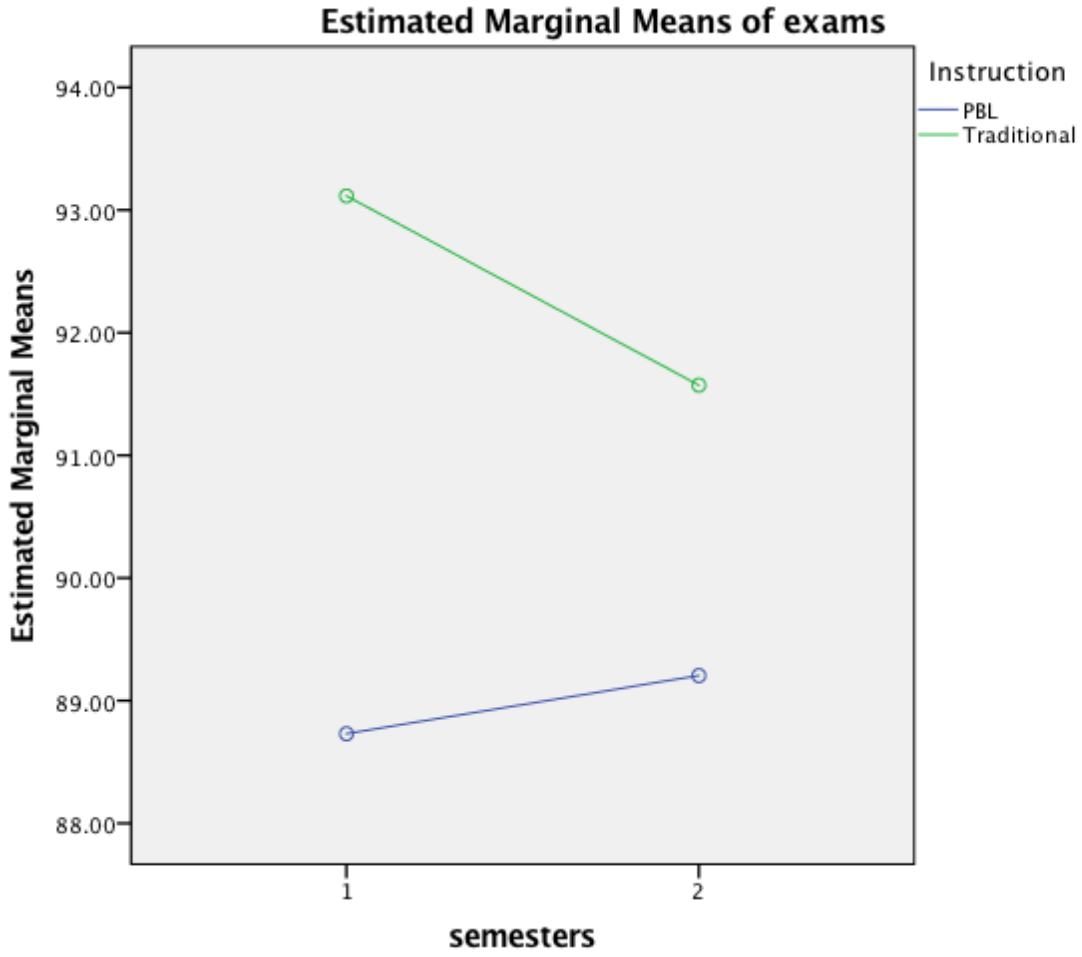


FIGURE 2

Estimated Marginal Means of Examinations



Qualitative results. Observation processes ensured that the instructor was following through with either PBL or traditional teaching methods. Throughout each semester, there were persistent themes in student learning and instruction. Students in the PBL and comparison group were essentially assigned the same projects, participation assignments, and exams. However, the instructor implemented PBL techniques with the PBL group as mentioned. The comparison group did not receive the same type of instruction.

Semester one observations. The instructor implemented PBL principles in the PBL group. In following Blumenfeld et al. (1991) and Krajcik et al. (1994) design principles, the instructor followed the first principle as the driving/guiding questions were addressed for most projects and activities. On one occasion, the instructor did not address the driving question but allowed students to explore this question related to a particular class assignment by asking students to think and reflect on their own experiences. Reflection was something the instructor executed well in 100% of her classes.

The instructor followed the second design principle in that students explored their project driving questions through student discussion and collaboration in all classes. At one point during the semester I recommended that the instructor allow students to further explore the driving question(s) through their own experiences so students could additionally construct knowledge based on their experiences. The instructor followed this recommendation throughout the remainder (last half) of the semester.

The instructor followed the third design principle, where the instructor and students worked together to find solutions to their driving questions. The instructor implemented this principle by acknowledging student-teacher collaboration in all classes.

Furthermore, the instructor followed the fourth design principle by supporting and scaffolding student learning. The instructor did this through answering student questions and implementing the use of classroom tools (i.e. videos, peer-reviewed papers) and technologies in each of the classes I observed.

Finally, the instructor followed the fifth design principle by allowing students to address their driving questions and findings to the classroom. Students addressed their driving questions at the end of the semester through classroom presentations.

The PBL and comparison group completed the same PBL projects. It is worthy to mention that the instructor made the two classes as distinct as possible, though projects in both classes incorporated PBL principles.

The comparison group always finished class much sooner than the PBL group, which might be attributed to the fact that the instructor spent less time having students collaborating and working on projects. The PBL class typically finished class with no time to spare.

One major theme in my observations was that the PBL class appeared to be more off task than the comparison group. 87% of my observations demonstrated that the instructor had a difficult time engaging students in discussion and keeping them on task. Thus, the instructor had to continually find ways to engage the PBL class through collaboration, discussion, videos, and the use of many examples to ensure students were constructing meaning of the content. 80% of my observations indicated that the comparison group did an exceptional job of initiating discussion, despite the instructor's attempts to be more lecture-driven. The PBL group discussed course content in each class, but the comparison group had more advanced and intellectually-based discussions as observed.

During 13% of the PBL classes, the instructor needed to stay on schedule with course content, which meant she focused more on information dissemination while the students collaborated less than PBL would promote. Consequently, it was more difficult

to gain the attention of the class. Even though the instructor had a difficult time capturing the attention of the PBL students during lecture, they were engaged in activities that involved group collaboration.

I was unable to observe the students working on their class projects because they observed their chosen elementary student inside an elementary school classroom. Because of this, I could only document student project experiences, results of the satisfaction survey, and final presentations of student semester-long observational work. I was also only able to attend final presentations given by the PBL class. Therefore, I could not observe or determine if students in the comparison group enjoyed their projects or constructed knowledge through doing this project.

For the projects, students were asked to observe and present child development in three areas: physical, cognitive, and social-emotional development. During the presentations, students gave background information about their elementary student, presented each aspect of the development of their elementary student, and considered recommendations of child/student development in the classroom. Each PBL group student said they enjoyed their work with the elementary student of whom they chose to observe. All students related their observations to their theories discuss in class throughout the semester.

Semester one: Instructor interviews. I administered two instructor interviews. The purpose of these interviews was to assure the instructor and I had the same impressions of my observations. During the first interview, we agreed on the observations I made in the PBL and the comparison group. I mentioned that the

comparison group did not seem to be implemented in a way where the instructor only traditionally lectured. The instructor agreed with this comment:

> Due to the structure of the classes within the elementary education program (most notably the fact that we only meet one day per week for 2 ½ hours) I've never really taught these courses as a *strict* traditional lecture. I have always included a lot of discussion, encouraged questions, and used video clips to help show some of the more abstract and theoretical ideas in a more concrete manner.

80% of my observations indicated that the comparison group students were engaged and initiated discussion. The instructor also agreed with my comment that the comparison group took initiative in asking questions and opening collaborative discussions:

> I agree that traditional [comparison] group does certainly take a lot of initiative in asking questions and starting discussions but I wouldn't necessarily say that this is what is causing me to divert from a traditional lecture format. If they weren't initiating the questions and discussions, I would likely be initiating some of them myself to break up the monotony of the lecture content and also to informally check their understanding of what is being presented/discussed.

During the second interview, the instructor and I agreed that most participation assignments implemented in the PBL class were a great way to engage students. Based on my observations, 67% of these assignments were influential in engaging students. Participation assignments allowed students to discuss course content using various theoretical frameworks that were previously discussed in class. The instructor explained:

> The [participation] discussion…really allowed students to connect their own experiences as students and as teachers with psychological constructs related to the course. Doing this at the beginning of the class made the instruction seem more student-driven and even when we switched to the lecture content I was able to reference and draw upon the student's ideas and discussion points from the beginning of class.

Participation assignments were also given to the comparison group. During 67% of these assignments, comparison group students initiated discussion even though the instructor focused less on student collaboration. The instructor mentioned:

> The traditional [comparison] group is very inquisitive so they did ask many questions on their own…While these students were still constructing some of their own learning and understanding it didn't feel as though their connections were as deep as those the students in the PBL group made.

Instructor self-evaluation. During the interview process, the instructor had the opportunity to self-evaluate. On one occasion, the instructor mentioned that the PBL group was behaviorally challenging. The instructor explained:

> The PBL group was rather challenging behaviorally...Several of the students were off-task and had difficulty staying focused during both lecture and collaborative/discussion activities. I had to do more redirecting than usual to help students get back on task. The following week I used a matching quiz as a formative assessment to see how much of the basic information discussed in that class was retained by the students. While a few of the students did well, most of them really struggled and got half or less of the matching items correct. I feel it is imperative that students in both groups have a solid grasp on the basic concepts in the class in order to complete their case studies successfully. For the PBL group I think it is even more important as this basic understanding is what allows students to have more in-depth academic discussions with their peers.

The instructor overcame this dilemma and this experience offered a chance to provide other learning opportunities for the PBL group to re-evaluate the content to develop a deeper understanding. To overcome this dilemma, the instructor implemented a pop-quiz to establish students' understanding of the course content.

During the second interview (nearing the end of the semester), the instructor was pleased with the PBL group's discussion and described:

> The students were really building some strong and meaningful connections between previous course content and their own experiences and using those connections to interpret and think about the topic of bullying addressed in the article. My impression as an instructor was that this type of instructional activity really fostered a more in-depth and personal learning experience that I suspect will be more impactful in terms of actual application once these students are teaching in classrooms of their own than the more traditional lecture format of instruction.

Such remarks indicate that the PBL students were beginning to become attuned to PBL methods and that in-depth and personal learning experience is important for students to be able to connect content to actual human development during the last month of the semester.

Semester two observations. PBL design principles developed by Blumenfeld et al. (1991) and Krajcik et al. (1994) support the instructor's teaching approach in the PBL group. Throughout the semester, the teacher used driving questions to initiate each project and students explored these questions by creating their own instructional objectives, assessments, and scoring criteria to guide their learning. The instructor implemented student collaboration in their projects and all classroom assignments. Through the project process, the teacher supported and scaffolded student learning by providing examples instructional objectives, assessments, and scoring criteria, as well as clarifying any questions or concerns students had regarding the content in all classes. At the end of the semester, PBL students addressed their driving questions to their classmates through informal presentations and group discussion.

The PBL and comparison group completed the same PBL projects. Though the instructor made the two classes as distinct as possible, projects in both classes incorporated PBL principles.

During the first half of the semester (50% of my observations), the PBL group had a difficult time concentrating during lecture and discussion. I observed most of the students spending time browsing the internet or having side conversations; therefore, the instructor had to continuously find ways to keep the class on task by prompting questions, implementing activities (i.e. the use of tools), or having students incorporate personal experiences to further engage the class in the content. Specifically, the instructor incorporated more (in comparison to semester one) class activities and examples to support student knowledge construction of learning objectives. For example, class activities prompted students to write instructional objectives. To engage students, the instructor displayed a list of objectives in the front of the class while students determined which objectives were measureable for learning or not.

Nearing the middle of the semester (20% of my observations), the PBL group became more engaged in activities continuously implemented via the instructor by evaluating and creating course assessments and scoring criteria; although, I still observed disengagement among some students. By the end of the semester (30% of my observations), I observed that the PBL class was actively engaged in class discussion and group collaboration. Students did not deviate from the task-at-hand by browsing the internet or having friendly conversations and were having intellectually-based conversations about the content matter.

Throughout the semester, the instructor allowed the PBL group to work on their projects during class, as the PBL method would suggest. Students collaborated on their projects both individually and in groups throughout the semester. If students needed new ideas, they were always instructed asked their peers for help. During collaboration, the

instructor continuously walked around and answered any questions students had throughout all classes.

The comparison group continued to have intellectually-based conversations and self-initiated discussions during lecture. In this semester, I only had the opportunity to observe the comparison group on one occasion because the time of this class conflicted with the time I taught a class. Throughout the qualitative analysis, I compare groups based on my observations, but also relied on notes created by the instructor when making further comparisons or comments between groups.

Assessment activities included student presentations in both the PBL and comparison group. Rather than lecture, the instructor chose to have groups of students work together to write and teach their peers particular (yet different, from group to group) types of test items. There were considerable differences in presentation styles in the PBL and comparison group. Presentations were instructed to be a maximum of 20 minutes long for each group and students worked in groups of about 3-5. In the comparison group, students fulfilled their 20 minute presentations through typical lecture format while including in-class activities to teach their peers about particular assessment items. Their peers asked the presenters questions to clarify content, which engaged conversations amongst the entire class. The PBL group did not perform well with the presentations. Their presentations only lasted for 10-15 minutes each. Only two (out of 19) classmates asked the presenters questions, so the class had only a small opportunity to engage in discussion of assessment types. A few of these presentation groups also lacked examples and further explanations of the presented content. Their audience (i.e.

peers) seemed to be listening to the presenters, but the class in general did not present the content as per the timing and content guidelines.

To learn how to create scoring criteria such as grading rubrics, the instructor presented the PBL class with examples of actual rubrics. The instructor explained what was correct or incorrect about each rubric format. Students again had the opportunity to work in groups and use rubrics to grade student responses, which allowed students to compare their grading to their peers' grading. This assignment led students to begin to discuss reliability and validity using appropriate grading rubrics before the instructor lectured about the topic. During this activity, students were completely engaged in the task at hand and I observed no outside conversations.

For all other class PBL assignments, the instructor had students work in groups while walking around and answering any student questions. As discussed, students eventually became engaged with each other through the semester while trying to figure out a solution to the assigned problem. The instructor checked their answers to see if they were correct; if they were not she allowed students to re-evaluate their work before they moved forward with content.

Semester two: Instructor interviews. Throughout this semester I administered three instructor interviews to ensure the instructor had the same impressions of my observations. During the first interview administered in the beginning of the semester, the instructor and I agreed that the PBL group still had a difficult time focusing on the topics at hand. The instructor found ways to engage the students by allowing students to relate the content to their personal experiences. The instructor elaborated on the differences between the PBL and comparison group and mentioned:

> I think that the experimental [PBL] group has the potential to really benefit from PBL instructional activities... They have a lot to say and have some really great insight about many topics but the key seems to be finding content that they will really be able to relate to. When the content is something that they have personal experience with or something that they have a definite opinion about they are highly engaged and capable of making some great connections between course content and practical experience. The main difference that I notice between the experimental [PBL] and control [comparison] group is that the control [comparison] group puts in a great deal of effort to connect with the majority of the course content even though it isn't delivered using PBL strategies. As a group, they are very invested in learning and mastering the content.

In relation to the group presentations, the instructor agreed with my observations regarding the PBL group having a more difficult time presenting assessment styles than did the comparison group and described:

> It was really interesting how the difference between the group personalities was so apparent during the student presentations. I do think that part of the difference was due to the fact that the experimental [PBL] group's morning class had been cancelled so they were a bit out of their routine and…in a bit of an 'oh this will be an easy day' kind of mindset. But I suspect that even if their morning class had been held as usual they would have been more eager to just get through the presentations and check off the boxes than the control [comparison] group…In general…the experimental [PBL] group seemed more focused on getting through the presentations and getting a grade whereas the control [comparison] group was more focused on practicing and applying best practices of teaching.

During the second interview (in middle of the semester), the instructor corresponded with my observations that the PBL group began to engage more, specifically in the reliability/validity activity, which occupied students' attention. The instructor explained:

> The reliability and validity activity is always one of my favorites. The students really enjoy reading through the elementary students' sample writings and using them and asking them to

> evaluate/score them has been a great way to introduce some pretty abstract concepts and allow them to have hands-on experience with what inter-rater reliability looks like and why it's important. By allowing them to first talk about reliability and validity as it relates to grading and scoring student work it seems to give them a concrete place to start from when we then talk about reliability and validity as it relates to standardized tests.

At this point in the PBL class, students worked through writing instructional objectives, assessments, and scoring criteria. The purpose of each collaboration and discussion was to prepare students for their projects. At this time, students had not yet completed their third PBL project. Up until this point, I observed that each in-class activity and project incorporated PBL methods, particularly instructor scaffolding, which gave students the opportunity to build their knowledge through the process of doing tasks in-class and with their peers. The instructor agreed:

> So far the PBL curriculum is going pretty well. The students have now worked through writing instructional objectives and creating test items to assess some of those [instructional objectives]. The group projects/presentations about the test items seemed to be an effective way for many of the students to get some experience and practice with the 'rules' of writing various types of items before having to create them on their own. [For the third] assignment they will be creating a performance assessment and corresponding scoring materials to assess other [instructional objectives] from their first assignment. This is usually the most time consuming of all the homework assignments but often the students' favorite because it allows them to be more creative and many of the students hadn't realized that many of the 'fun projects' that they did in school were actually assessments. Once the third assignment is done the students will have a rather comprehensive assessment plan for their sample instructional unit.

Nearing the last month of the semester, the instructor continued to take the scaffolding approach to teaching by having students work on projects to establish a baseline of knowledge before the instructor lectured about the content. Closer to the end

of the semester, students shared and discussed their final PBL projects with their peers and instructor. I was unable to attend these informal presentations; therefore, I could not conclude if students in the PBL group enjoyed their projects or constructed knowledge through doing this project. Nonetheless, the instructor generally agreed that the PBL group improved in their collaboration skills from the beginning to the end of the semester. The instructor also noted that the comparison group was still very engaged as usual, but those skills declined towards the end of the semester:

> Both groups' [comparison and PBL group] discussion of their projects were thoughtful and demonstrated their growth and understanding of the course content. It was very interesting to me that as this semester progressed the control [comparison] group became more and more difficult to engage (very unusual for them). I would describe this group as very mastery oriented and I think they were reaching the point of burn out. I wonder if doing more PBL instruction in this group would have prevented some of this burn out/lack of participation in the control [comparison] group. In the end they still performed well in the class but there were several weeks towards the end that were rather painful to teach. They were just done. Even though the experimental [PBL] group tended to be a little more 'spirited' and more challenging to keep on task, they participated and interacted consistently throughout the semester all the way to the end.

Instructor remarks indicate that the PBL group improved in their collaboration skills over the course of the semester, whereas the comparison group had a more difficult time engaging in meaningful discussion and collaboration by the end of the semester.

Instructor self-evaluation. Through self-evaluation, the instructor took steps to help the PBL group engage in more meaningful discussions through support and scaffolding of student knowledge. As mentioned, the PBL group initially had a harder time engaging in the course content. The instructor was aware and explained:

> I would like to find more ways and more topics related to assessment to help engage the experimental [PBL] group in more, meaningful discussions…I think they have some great things to say, they just need the structure and support to help them begin making these kinds of connections. They aren't quite ready to do that on their own.

To support student knowledge construction, the instructor implemented many class activities and group discussions to aid in student knowledge development throughout the remainder (75%) of the semester.

Nearing the middle of the semester, I found that the instructor's PBL approach began to influence the PBL group. The instructor noted the differences between the comparison and PBL group and said:

> At this point in the semester it is actually the control [comparison] group that is struggling in terms of participating and staying on task in class. While I do think that group tends to be more academic I think they may be burning themselves out. It seems like they are spending a lot of my class time on their computers working on things for other classes. I have actually had to address their behavior directly a couple of times because it has become disruptive and distracting to other students. I am curious to see how they do with the assignments for my class since they have been a bit preoccupied during instruction.
>
> The experimental [PBL] group on the other hand is still rather spirited and can be hard to keep on task, but when they are on they are ON and discussion seems to be pretty in-depth and engaging. Their comments and questions lead me to believe that they are doing some good critical thinking about assessment and how best to use it in their classrooms.

By the end of the semester the instructor thought:

> PBL instruction seemed rather effective with this [PBL] course and its content. While it was sometimes challenging to keep everyone on task I think that there was a lot of valuable learning and discussion that took place.

Generally speaking, the instructor and I tended to have similar observations of the learning and instructional approaches in each group and semester. The interviews were beneficial for two reasons. First, they allowed the instructor and I to present ideas to each other that support PBL principles. Second, they allowed the instructor and I to assess our impressions of PBL classroom observations while improving on those methods from the first to second semester.

DBR instructional changes between semesters. In comparison to semester one, PBL students in the second semester asked many more questions and engaged in meaningful discussion and collaboration, which may be attributed to the instructional design improvements. The instructor strengthened project driving questions from semester one to semester two. In semester one, driving questions that initiated classroom activities reflected more generalized views of child development, without taking into consideration the importance of how childhood development applies to the students' future classrooms. In semester two, driving questions were improved to more closely align with how students can effectively implement assessment as future teachers.

The instructor also implemented more classroom activities in the PBL group from semester one to semester two. In semester one, there were no classroom activities that supported student understanding of their observation of childhood development projects. To support student knowledge construction in semester two, the instructor implemented in-class activities that aligned with the content for student projects. Thus, students had the opportunity to practice creating assessment before actually submitting their projects, which supports the PBL framework of learning through a process of doing.

In semester one, PBL students were off-task during most lecture and discussion. Even when students were off task, the instructor was attuned to re-engaging students in the task at hand by prompting questions. In semester two, the instructor became more attuned to asking students and using personal experience to lead group discussion. Because of this, the instructor had the opportunity to further support and scaffold student learning in semester two through strengthening driving questions, implementing activities and presentations, and prompting meaningful questions that supported collaboration and learning.

From my observations, the comparison group still had intellectually-based, meaningful, and initiated group collaborations of course content. By the end of the second semester, the instructor made note that it was difficult to engage this group though the instruction did not change from semester one to two.

RQ2

Quantitative results. In semester one, 89% of PBL students completed the student satisfaction survey. On a 7-point Likert-type scale, students were generally satisfied with PBL curriculum and instruction ($M = 6.55$, $SD = .20$). Out of all responses, no student strongly disagreed, disagreed, or somewhat disagreed with the PBL curriculum and instruction.

The semester one survey was intended for PBL students. I wanted to determine what the comparison group thought about the class curriculum and instruction, so I revised the survey for semester two to reflect a generalized view of curriculum and instruction; although, survey questions were tailored to PBL methods. Students in both groups mostly agreed or strongly agreed with the course curriculum and instruction.

In semester two, all PBL students completed the survey and 95% of the comparison group completed the same survey. On the revised 5-point Likert-type scale, the PBL group was generally satisfied with PBL curriculum and instruction ($M = 4.76$, $SD = .11$) and the comparison group was also satisfied with the curriculum and instruction ($M = 4.80$, $SD = .09$). There were no statistical differences between the groups.

Qualitative results. In semester one, 53% of PBL students made additional comments concerning their thoughts and opinions of their instructional and curricular satisfaction. The comparison group did not receive the survey because the survey was designed for students in the PBL environment. In the second semester, 71% of PBL students made additional comments regarding their satisfaction with the instructor and curriculum; 78% students in the comparison group made additional comments. In general, the results indicated that students in both groups were satisfied with the instruction and classroom curriculum.

Semester one: Instructional satisfaction. In general, 67% of PBL students made comments about their liking of the instruction and instructor:

> [The instructor] did a great job in conveying the importance of the different developmental theories in children. Was one of the best instructors I've had!
>
> Has a lot of energy which makes the subject more interesting to learn.

Of these comments, 44% included PBL references:

> [The instructor] is amazing! Instead of just reading the powerpoints, they were really interactive. Instruction was clear, focused, varied (verbal/visuals/examples-videos) and interesting. I felt that I understood all topics, and appreciated how in tune the instructor was to our need to review topics when necessary.

In the first comment, the student referenced the instructor's lecture powerpoint slides as being interactive, which conveys the use of classroom collaboration. In the second comment, the student identified the instructor's use of verbal and visual examples (i.e. videos), which supports PBL through the use of classroom tools that support student knowledge construction. The same comment also described how in-tune the instructor was to student learning, which demonstrates that the instructor was supporting and scaffolding student learning. Two other comments explained that the instructor was knowledgeable of the content because she was able to easily communicate content matter. No student noted that they were unsatisfied with the instruction or instructor.

Semester one: Curriculum satisfaction. PBL students also made supportive comments of the course curriculum. In general, 71% of students expressed their liking of the course curriculum:

> Exceeded throughout the entire semester.
>
> The teacher was enthusiastic, therefore we wanted to learn the curriculum.

Of these comments, 14% of students referenced the PBL framework:

> I do well with hands on and short videos. Sometimes too much reading or lecture can be overwhelming on my brain.

Again, the comment describes the instructor's use of classroom tools (i.e. short videos) as a way to help students construct knowledge. 29% of the comments explained the curriculum was useful for the student's future career:

> Satisfactory; there were enough assignments for me to apply what I have learned, but they were not overwhelming.
>
> Very applicable to teaching and interesting to learn about in general. Satisfied.

No students mentioned dissatisfaction with the curriculum.

Semester two: Instructional satisfaction. In the second semester, 92% of PBL students made general comments about their liking of instruction and instructor:

> The best teacher I could have asked for these past two semesters.
>
> Fantastic teacher genuinely cared about our learning.
>
> The best instructor that I've ever had!

Of these comments, 33% of them included PBL references:

> Very helpful and relevant.
>
> Great techniques for engaging students
>
> I love that this instructor designs meaningful focused assignments that teach me a lot but never feel like busy work. I feel like I learned more in this class, because I did not disregard any assignments as not important.

In the first comment, the student mentioned that the instructor was helpful, which lends support to scaffolding student learning through PBL. The second comment describes that the instructor implemented classroom collaboration. The third comment referenced PBL in that the instructor created meaningful classroom tasks, which supports student knowledge construction through the PBL framework. 17% of students reported that the instruction was valuable to their future profession:

> Very useful course, directly applicable to our profession.
>
> Always enjoy this class because we are tested on what we learn in class, and it applies directly to what we will be utilizing in the classroom when we are teachers.
>
> Everything I learned in this class was very helpful for my future classroom.

No students made negative comments regarding the instruction or instructor.

The comparison group revealed similar experiences as the PBL group. 100% of students said they generally liked the instructor and instruction:

> This instructor has always strived to meet our every need. She is personable, and does a very good job at being in tune with the class-thus has great participation.

> The instructor is knowledgeable, helpful and the nicest person I have ever met.
>
> Instruction was clear, well designed, and effective.

Of these comments, 46% of students referenced PBL instructional methods:

> The teacher was very helpful and always encouraged my learning. I always felt comfortable asking questions and asking for help.
>
> Instruction was very good, instructor made class fun and interesting. Instructor also had a lot of knowledge and showed passion for content being taught.
>
> Our teacher is awesome engaging instruction!

The first comment conveys that the instructor supported and scaffolded student learning. The second comment communicates that the instructor has knowledge—something teachers need to have to teach and support student learning. The third comment reflects collaboration in a PBL environment. Another comment explained that the instructor created authentic assessments. In a PBL environment, authentic tasks and assessments are implemented that allows students to construct knowledge. Also, 8% of students reported that the instruction was beneficial for them to apply their knowledge in future circumstances:

> The teacher was caring and created authentic assessments to help me learn and apply my knowledge.

No student expressed dissatisfaction with the instruction or instructor.

Semester two: Curriculum satisfaction. During this semester, 86% of PBL students claimed they generally liked the course curriculum:

> Helpful for understanding student behavior in the classroom.
>
> The curriculum was interesting, captivating, and enjoyable for me to learn.

Of these comments, no student referenced the PBL framework or how the curriculum was beneficial for their future careers. One student mentioned their disappointment with the curriculum:

> Dry content, but well presented.

No other student described their dissatisfaction of the course curriculum.

The comparison group felt similar to the PBL group about the curriculum. 100% of student comments described their liking of the curriculum:

> I was satisfied with the course content.
>
> I understood the topics that were discussed. Spoke clear, very organized, and the handouts/practices are helpful.
>
> The information as all very useful!

Only 7% of these comments referenced PBL:

> Reliable…Authentic…Realistic.

This comment describes that the instructor implemented authentic tasks in the comparison group to support student learning. 36% of students described the curriculum as relevant to their future profession:

> Very applicable to my future needs.
>
> Curriculum was beneficial to preparing me to become a teacher.
>
> The curriculum was very beneficial to my future and I gained a lot of knowledge.
>
> The curriculum was very educational towards my degree and I learned a lot.

No comparison group student portrayed dissatisfaction with the curriculum.

Student satisfaction in the PBL and comparison group aligned with PBL design principles (Blumenfeld et al., 1991; Krajcik et al., 1994) in multiple ways. Students were able explore a topic of interest. Students were also able to learn by doing and were able to find answers to their project inquiries by learning in a hands-on manner. Furthermore,

students were able to learn through interactive and collaborative methods. Within this collaboration, students were supported and scaffolded by their instructor through the use of classroom tools and technologies when the instructor would incorporate visual learning opportunities. Last, though it was not mentioned in student comments, students addressed their project findings to the class at the end of the semester one. In semester two, only the PBL group addressed their findings. Of most importance, students mentioned that they were able to apply what they learned to other contexts, which supports the idea that learning happened because students constructed meaning about their ideas (Singer et al., 2000). The comparison group was not aware of PBL methods, which made it interesting to see the similarities in instructional and curriculum satisfaction between groups.

CHAPTER 5: DISCUSSION

The first goal of this study was to determine if PBL improved student achievement in semester one, semester two, and longitudinally. The second goal of this research was to determine if students were satisfied with PBL methods. I predicted that PBL would have a positive effect on student achievement and student satisfaction. The lower performance for the PBL group in semester one, nonsignificant results in semester two, and overall PBL performance between both semesters disconfirm my hypothesis and may not lend support to the social constructivist theory.

In semester one, quantitative analyses resulted in significant differences between the two teaching approaches (i.e. PBL and traditional), where the comparison group outperformed the PBL group. Also, students were generally satisfied with PBL methods. Qualitative data revealed that the instructor followed through with PBL instructional methods in the PBL group and that students expressed their liking for PBL instruction and curriculum.

The means of the class assignments in semester one indicated that the comparison group outperformed the PBL group on the class projects and examinations. However, the PBL group outperformed the comparison group in completing participation assignments. Participation assignments included all or nothing grades. Thus, students had to arrive to class, participate, and collaborate about the course content to receive points.

The PBL students may have done poorer than the comparison group on the projects for multiple reasons. Primarily, the PBL group's average learning ability may have been lower than the comparison group to begin with. Also, PBL students may have been more experienced learning through traditional teaching courses and were unfamiliar

with the PBL teaching and learning methods. For example, students may have been inexperienced with learning by doing projects or through collaboration. Additionally, students may have had less experience with the course content, whereas the comparison group students may have had previous courses that supported their current understanding of the content in each study. Furthermore, PBL students had a harder time cooperating with staying on task. Oliver (2001) claimed that in cooperative learning environments where students have the opportunity to discuss content, students are able to develop an understanding of the subject matter. A lack of cooperation may also explain why the PBL performed worse on exams because they did not construct as much meaning of the course content doing the projects as did the comparison group.

In semester two, quantitative results indicated nonsignificant differences in performance between groups. The comparison group outperformed the PBL group in all graded areas after reviewing the mean scores. Qualitative data show that the instructor followed through with PBL instructional methods in the PBL group. Also, student satisfaction surveys between groups suggested that both PBL and comparison group students were satisfied with the course instruction and curriculum.

The comparison group outperformed the PBL group in most areas, but point differences between groups were very small—even when the PBL group scored lower on the participation assignment than did the comparison group in the second semester. In semester two, the small effect size ($\eta^2 = .06$), indicated small point differences on projects, examinations, and participation assignments between groups. Over time, PBL students reduced the learning gap between groups, though there were no differences between the groups. Arguments by Bjork and Bjork (2011) may explain why the PBL

group's initial performance may have improved over time. Bjork and Bjork argued that initial learning difficulties can lead to more flexible learning. If learning happens through a process of interpretation, students can map new learning onto something they already know. Therefore, students may have improved from semester one to semester two because they became familiar with PBL methods and could map their new learning in semester two onto their experiences in a PBL classroom from semester one.

Quantitative longitudinal analyses indicated that there were mean differences between instruction types over the two semesters (i.e. semester one and two) and that overall student performance changed from semester to semester depending on the type of instruction they received. In reviewing the estimated marginal means of projects from semester one to two, the PBL group improved over time, whereas the comparison group declined in performance over time, though the comparison group still outperformed the PBL group. When looking at the marginal means of examination scores from semester one to two, the PBL again improved over time, while the comparison group declined in performance from time one to time two. In semester one, theoretical content was difficult for the PBL group; in semester two, the applied assessment course was more beneficial to the PBL group's achievement. Arguments by Blumenfeld et al. (1991) claimed that students who are engaged in PBL methods over a long period of time retain a deeper understanding of the subject matter, which may also explain why the PBL students performed better over time.

Longitudinal results do not support the previously mentioned five studies with preservice teachers that determined PBL to be effective for student learning; although, student PBL satisfaction was consistent with the results of each of these studies (Frank &

Barzilai, 2004; Hernandez-Ramos, 2007; Land & Greene, 2000; Papastergiou, 2005; Wilhelm et al., 2008).

Extraneous variables may have affected the PBL group. As briefly mentioned, the PBL group may not have had experience with a PBL classroom. Hands-on projects, inquiry, and collaboration are key components of constructing knowledge (Thomas, 2000). In semester one and two the comparison group demonstrated those abilities and outperformed the PBL classroom. However, it takes time for students to learn nontraditional instructional approaches to learning (Blumenfeld et al., 1991). Additionally, the comparison group appeared to be an anomaly compared to the PBL class. While the instructor intended to lecture for most of this class, the instructor only lectured for slightly more than half the classes because students took it upon themselves to engage in classroom discussion and collaboration on course content.

The courses include a close cohort of students. It is understood that it is rare that any student dropout of classes at this phase in the program. Students who take the educational psychology child development course take the assessment course in the subsequent semester (i.e. semester one to two). Within this cohort, there was a difference in the PBL versus comparison group. In the comparison group, many of the students were friends, which may also explain why this class was more likely to engaged in collaboration because they were more comfortable with each other

In both semesters, the comparison group implemented PBL collaboration methods by engaging themselves in the classroom content more than the PBL group. Thus, students in the comparison group created artifacts (i.e. understandings of course content)

(Blumenfeld et al., 1991), which led to the lack of a true control group. In the PBL group, the instructor had to continually engage students in discussion.

Results of this study may have fared differently had the comparison group in this study been initially assigned as the PBL group. As discussed in the results, the instructor thought the PBL group had the potential to benefit from the PBL method, particularly when they use personal experience to connect content to practical application. The comparison group tended to put effort in bridging theory to practical application. Even though the teacher made instruction distinct as possible between classes, the comparison group was constantly engaged in the content matter. Their engagement supports the PBL framework. I postulate that had comparison group students been assigned the PBL group, results of this study would have favored my hypothesis.

Limitations

One limitation stems from the projects the comparison and PBL group completed. Projects, examinations, and some participation assignments between both groups were the same. I worked with an inexperienced instructor of PBL. Therefore, instructor was on a trial-and-error basis learning the fundamentals of a PBL classroom. It appeared as if the instructor did not struggle with conforming to PBL curriculum and instruction principles. However, the instructor may not have had the experience to experiment with two different teaching methods in two of the same classrooms between semesters. Between groups, there was also no difference in instruction, considering PBL instructional methods were observed in each group.

Another limitation includes the materials and projects used for this study. The materials and projects used were previously part of the course curriculum for each class.

Projects were only modified and adapted for the PBL framework instead of being newly created. This study may have seen different results had the curriculum been created in an innovative way.

In semester one, student projects were discussed in class, but their observations and much of their project work was done outside of the classroom. Consequently, PBL students may not have been able to receive immediate support and scaffolding from their teacher to help them bridge theory to actual human development. If students had immediate questions about the applicability of theory to one's development, they did not have the opportunity to get those questions answered until their weekly class time. By this point, students may have forgotten questions they had to help them with their projects.

Participation assignments were graded as all-or-nothing points per assignment. Most students earned points for these tasks in semester one and two. Thus, I was unable to analyze these grades due to little variability in scores. Despite limitations that may mimic real-life situations, the comparisons and gains made by both groups are informative to instructional practices.

Implications

I anticipated that PBL would help both students and the instructor. Specifically, I expected that PBL would help students construct knowledge through hands-on projects, group collaboration, and instructor scaffolding and anticipated that student experiences with PBL would help them develop the skills to apply this learning method to their own future courses. Unfortunately, I do not have evidence to claim that PBL is effective or applicable to preservice teachers.

Longitudinal results may support the theory of social constructivism. I observed that PBL students constructed knowledge in two ways. First, students accomplished the observation projects, which allowed them to construct knowledge through doing hands-on activities and construct knowledge through social interaction by participating in group discussion. Second, although the comparison group initiated more group discussion on their own and the instructor mandated that the PBL group discuss and collaborate on ideas and projects, the PBL group overcame this challenge nearing the end of the study. As determined in the qualitative portion of the student satisfaction survey, PBL students said they were able to construct an understanding of course content and bring this knowledge with them to their future teaching jobs; although, I do not have further data supporting these comments.

Future Directions

Results did not determine the effectiveness of PBL methods with preservice teachers. In comparison to traditional teaching methods, research has found that PBL is more effective than traditional lecture-style methods (Geier et al., 2008; Mergendoller et al., 2006). Avenues for future research should further evaluate PBL in preservice teachers taking educational psychology courses while comparing them to a true control group.

There has been little research regarding the implementation of PBL at the collegiate level. Until now, research has not examined the effects of PBL in preservice teachers taking educational psychology courses. The strength in this research included in-depth quantitative and qualitative measures of PBL implementation and observation. While studies have supported the effectiveness of PBL and instruction in grades K-12

(Thomas, 2000; Blumenfeld et al. 1991) and at the collegiate level (Helle et al., 2006; Papastergious, 2005), further research needs to be completed to determine additional effectiveness in preservice teachers taking educational psychology courses.

APPENDIX A

Semester 1: Case Study Plan
(Hard Copy Due 2/5/2015 - 10 points)

Case Study Guiding Question:
How can developmental theories of psychology be applied to individual students in the classroom to help create a learning environment that is developmentally appropriate?

Throughout the course of the semester each of you will be asked to do a developmental case study on an elementary student in your mentor classroom. You can use the same student you have chosen for other case studies. Pseudonyms will be used to keep student information confidential. The purpose of the case study is to apply some of the developmental theories (specifically physical, cognitive, and social/emotional development) we will be discussing in class to experiences with your case study student. Most of the information you will need to complete the case study can be gathered through observation and the typical instructional interactions you will have in your mentor classrooms. You may need to interview your mentor teachers or the student in order to get specific information if you find you are not able to gather it otherwise. You will complete the case study in parts and receive formative feedback on each part so that you can make any necessary edits/changes before compiling all of the parts into a final paper that will then be presented to the class at the end of the semester.

Directions:
For your case study plan I simply need to know that you have identified a student that you will study over the course of the semester and get a general sense of what kinds of interactions you think you will be having with the student you have chosen. Please fill in pertinent information below. *Bring a hard copy of this assignment to class on 2/5/2015.*

1. Name (pseudonym) of the student you have chosen:

2. Age/grade level:

3. In a sentence or two, explain approximately how much time or during what activities throughout the day/in what capacity will you be working with the student?
   (For example, indicate if this is a student you are using for another case study. If, so will you have to interview the student, work one-on-one with them for a few lessons throughout the semester? Is this a student you will get to work with regularly in small group settings? Has your mentor teacher asked you to work specifically with this student during reading, math, etc.?)

APPENDIX B

Semester 1: Case Study Part 1
Physical Development
(Hard Copy Due 2/26/2015 - 20 points)

***Bring a hard copy of your assignment to class on 2/26 to submit**. There will not be a d2L dropbox. Assignments may be submitted through email for up to one week after the due date for half credit. All assignments received after the start of class on 2/26 are considered late and will be graded for half credit only.*

Case Study Part 1 Guiding Question:
What does physical development look like for elementary students in the classroom?

Purpose:
The purpose of this part of the case study is to provide basic information about the student you have chosen to study over the course of the semester as well as to begin applying some of the developmental theories (specifically physical development) we have been discussing in class to experiences with your case study student in your cooperating classroom.

Format:
This assignment should be typed *in narrative form* (12pt. font, double spaced). Be sure to address each of the topics below. Please edit carefully for grammar, spelling, and clarity- these will be graded. Provide citations for any borrowed ideas or text (don't plagiarize!). Use APA format for referencing any articles discussed in class or that you may have found on your own if you want to include any supporting information or ideas from them. If you want to cite material directly from a class lecture please use the following format:

> Freiberg, E.J. (2015). *Name/title of the lecture* [PowerPoint slides]. Retrieved from
> https://d2l.arizona.edu/d2l/le/content/399293/Home

Guidelines:
Describe the student you have chosen for your case study. You will need to provide the following information:

Basic/background information about your student:

- Name
- Age/grade level
- Current academic performance (how do they seem to be doing in math, reading, writing, etc.)
- What they seem to like or enjoy doing while in school, what they don't like
- Any other important background information

Physical development:
Address each of the following areas/topics related to physical development. Do they seem to be developing appropriately physically according to the guidelines discussed in class? Why or why not? What evidence do you have?

- Physical appearance (in comparison to their age/grade level peers)
- Fine and gross motor skills
- Senses (vision and hearing)

Grading: 20 points - a detailed rubric will be provided with your graded assignment upon return.
Format, spelling, grammar, and clarity will be considered within each of the above categories. Edit carefully. You will be given formative feedback for Part 1 so that you can make any necessary edits before compiling the final paper to be presented to the class at the end of the semester.

APPENDIX C

Semester 1: Case Study Part 2
Cognitive Development
(Hard Copy Due 4/9/2014 - 20 points)

Bring a hard copy of your assignment to class on 4/9 to submit. *There will not be a d2L dropbox. Assignments may be submitted through email for up to one week after the due date for half credit. All assignments received after the start of class on 4/9 are considered late and will be graded for half credit only.*

Case Study Part 2 Guiding Question:
How does cognitive development impact intelligence and academic achievement?

Purpose:
The purpose of this part of the case study is to provide basic information about the student you have chosen to study over the course of the semester as well as to begin applying some of the developmental theories (specifically cognitive development) we have been discussing in class to experiences with your case study student in your cooperating classroom.

Format:
This assignment should be typed *in narrative form* (12pt. font, double spaced). Be sure to address each of the topics below. Please edit carefully for grammar, spelling, and clarity- these will be graded. Provide citations for any borrowed ideas or text (don't plagiarize!). Use APA format for referencing any articles discussed in class or that you may have found on your own if you want to include any supporting information or ideas from them. If you want to cite material directly from a class lecture please use the following format:

> Freiberg, E.J. (2015). *Name/title of the lecture* [PowerPoint slides]. Retrieved from
> https://d2l.arizona.edu/d2l/le/content/399293/Home

Guidelines:
Describe the student you have chosen for your case study. You will need to provide the following information:

Cognitive development:
Choose one of the following developmental theories discussed in class and relate that theory to your case study student's current development. Do they seem to be developing appropriately according to this theory? Why or why not? What evidence do you have?

- Piaget's theory of cognitive development
- Vygotsky's sociocultural theory of development
- Information processing

Cognitive development in relation to intelligence and academic achievement:
Using theories discussed in class (Sternberg's Triarchic theory or Gardener's Multiple Intelligences theory) describe your students' intellectual and academic development.

- How do they compare with their age/grade level peers?
- Are there any concerns about learning disabilities or giftedness?
- What risk factors (if any) is your student facing that may impact their academic achievement?
- What kinds of academic expectations are placed on your student? Do they seem appropriate given your assessment of their current intellectual and academic achievement standing?

Grading: 20 points - a detailed rubric will be provided with your graded assignment upon return.
Format, spelling, grammar, and clarity will be considered within each of the above categories. Edit carefully. You will be given formative feedback for Part 1 so that you can make any necessary edits before compiling the final paper to be presented to the class at the end of the semester.

APPENDIX D

Semester 1: Case Study Final Paper & Presentation
Putting it all Together
Final Papers due 4/23/2015
Presentations will be 4/23/2015 & 4/30/2015

All presentations will take place in class. There will be a sign up sheet in class a few weeks before the presentations. You will sign up for a date/time to present on a first come first served basis. **You are expected to attend all of the presentations on both days.** If you cannot be in class the day you are scheduled to present, arrangements to present at another time need to be made in advance.

Case Study Part 3 Guiding Question:
How does social/emotional development impact students in the classroom?

Social/emotional development:
Your first task will be to evaluate your case study student's social and emotional development.
Identity and Self:

- Using Chess & Thomas's 3 types of temperament describe your student's temperament in the classroom.
- Based on your observations and interactions with your student evaluate their sense of self (self-concept, self-esteem, self-efficacy as a student).

Emotions and Interactions:

- Discuss how your student's emotional intelligence and emotional regulation skills impact his/her interactions with peers and teachers in the classroom.

Motivation:
Choose one of the following motivational theories discussed in class that you feel best fits your case study student and explain how this theory relates to his/her academic progress and behaviors in the classroom.

- Intrinsic/extrinsic motivation
- Attribution Theory
- Expectancy Value Theory
- Goal Theory

Final Paper and Presentation Purpose:
The purpose of this part of the case study is to present the information you have gathered about your case study student in relation to their physical, cognitive, and social emotional development. (Please note that you are expected to add information about social/emotional development as well as present information/recommendations for physical and cognitive domains of development.) Your paper and presentation should demonstrate your ability to apply and synthesize some of the developmental theories we have been discussing in class. At this point I would like to see evidence that you are thinking about the information you have gathered as a teacher.

The presentation is your chance to share the general information you have gathered and then discuss how that information would impact you as a classroom teacher. (Does this information change how you might deliver instruction to this student? Are there any interventions that you think this child might benefit from? Are there certain activities or assignments that you would want this child to complete in order to help foster their development in one or more of the three domains?)

Paper Format:
This assignment should be typed *in narrative form* (12pt. font, double spaced). Be sure to address each of the three developmental domains (physical, cognitive, and social/emotional). Please edit carefully for grammar, spelling, and clarity- these will be graded. Provide citations for any borrowed ideas or text (don't plagiarize!). Use APA format for referencing any articles discussed in class or that you may have found on your own if you want to include any supporting information or ideas from them.

Presentation Format:
Your presentation should be **no longer than 10** minutes and should **include some type of visual aid** (Powerpoint, poster, handout, etc.). *Be sure to practice your presentation before hand so that you don't run over the 10 minute time limit. You will lose points for running over the allotted time.* Your presentation should include the information about your student's physical, cognitive, and social emotional development that you think is most relevant/important as well as your recommendations as a teacher that you feel would help this child develop physically, cognitively, and/or socially and emotionally. No need for references unless you want to include them, but do provide citations for any borrowed ideas or text (don't plagiarize!). If you want to cite material directly from a class lecture, please use the following format:

> Freiberg, E.J. (2014). *Name/title of the lecture* [PowerPoint slides]. Retrieved from
> https://d2l.arizona.edu/d2l/le/content/341379/Home

Presentation and Paper Guidelines:
In your final paper and during your presentation include basic information about the student, their physical, cognitive, and social/emotional development. For your final paper, edit your narratives from Part 1 and Part 2 and add the information about your student's social/emotional development. Finally, compile them into a final paper detailing your case study student's development in each of the three developmental domains and discussing what implications their development has on their experience(s) in the classroom as well as recommendations that you would make to continue to further this student's development in the classroom.

During the presentation the majority of your time should be spent presenting/discussing your recommendations based on the information you gathered. Below are suggestions of information you may chose to include in your presentation.

Basic/background information about your student:

- Name
- Age/grade level
- Current academic performance (how do they seem to be doing in math, reading, writing, etc.)
- What they seem to like or enjoy doing while in school, what they don't like
- Any other important background information

Physical development:

- Development of fine and gross motor skills (examples illustrating or supporting your analysis)

Cognitive development:

- State which cognitive development theory you chose to use/apply to your observations. (Piaget, Vygotsky, Information Processing)
- Does your case study student seem to be developing appropriately according to this theory?
    - Why or why not?
    - What evidence do you have?
- What does this information tell you as a teacher?
    - What are your recommendations for this student in the classroom?

Social/Emotional development:

- Significant observations or information you gathered about the child's temperament, ability to regulate emotions, emotional intelligence, motivation in the classroom, self-concept/self-esteem, their identity, and interactions with peers.
- What does this information tell you as a teacher?
    - What are your recommendations for this student in the classroom?

Presentation Grading: 10 points – You will be graded based on the accuracy of the information you present, your ability to demonstrate understanding and application of various developmental theories to the classroom, and the quality of your presentation. I will be evaluating your presentation based on the following:

- **Knowledge/understanding of the theories used** (information about theories is accurate and explained clearly)
- **Thinking** (evidence of analysis/interpretation of information gathered about case study student)
- **Application** (appropriate recommendations for the classroom are given based upon the information gathered)
- **Communication/quality of presentation** (presentation does not exceed 10 minutes, visual aid is well organized/easy to follow, speaking is clear and easy to understand)

APPENDIX E

Semester 2: Homework Assignment 1
Instructional Objectives
(10 points – Due September 9)

Benchmark Guiding Question:
How can assessment inform planning and instruction in the classroom to help guide instructional decisions and ensure students are learning and making progress?

Please print your assignment and a copy of the grading rubric (on d2L). Attach them and give them to me at the beginning of class.

General: This is an opportunity to practice writing instructional objectives (IO). Create a content outline for a SHORT instructional unit, designate the state standards your unit covers, and write instructional objectives for your unit.

Considerations:

- Refer to the example assignment for questions regarding general format. If you still have concerns, contact the instructor immediately.
- Please type this assignment and that you make full use of spell check/grammar check features. Poor editing will result in loss of points.
- In order to be compliant with the university's Plagiarism policy, be sure to note where you found any outside source material. This includes state department of education websites detailing standards and any source of lesson plan ideas (including teachers and peers). Failure to cite sources will result in a zero for the assignment.
- I will provide formative feedback on this assignment. In other words, you can and should revise this assignment prior to submitting your course project for summative evaluation.
- Use and submit the attached chart to assist you in organizing your document and to help streamline the grading process.

Grading: In addition to whether you met the requirements described above, you will be assessed on

- quality of your learning targets/instructional objectives
- inclusion of appropriate state standards with source of standards
- correctness of the Bloom's level you designate for each objective
- coverage of your content outline
- accuracy of your connection to content standards
- spelling, grammar, and clarity

Note that failure to type the assignment or format using chart on page 3 will result in a return to you for point-penalized resubmission.

Instructions

1. See pages 4 and 5 for an example of this assignment. Use the example as a guideline for format and general information, but make your submission relevant to you and your teaching plans. Understand that examples provided are not ideal submissions, there ARE some flaws, but the example is provided as general information.
2. Select a SHORT instructional unit appropriate for the subject area and grade level you are teaching or plan to teach. Keeping the unit short will help you limit the number of instructional objectives needed to cover the content you have selected.
3. Make a content outline listing the topics you plan to cover in your unit.
4. Include a copy of the state or common core content standards and benchmarks that your unit covers. Remember that benchmarks are meant to cover an entire academic year; you may need to deconstruct the standards to make appropriate instructional objectives. Identify the source of your standards (web address).
5. List 5-8 instructional objectives for the unit. Be sure to follow the guidelines presented in lecture and in the text in crafting your objectives. At least 3 instructional objectives must tap Bloom's higher-level cognitive skills (application level or higher). Do not exceed 8 objectives. Here are some helpful questions to ask yourself when writing your instructional objectives.
    a. What is the underlying skill?
    b. Is it observable and measurable - will I be able to see a student demonstrate this skill on a test or performance assessment?
    c. Is it focused on the student?
    d. Is it too specific or too broad?
6. For each instructional objective, indicate which content standard, benchmark, and Bloom's cognitive level is being addressed.
7. Note which objective(s) would be appropriate for a performance assessment.

Relationship to Course Project:

This assignment is the first component of your Benchmark Assignment. As such, you will be asked to resubmit this assignment (the graded version and your revised version) with your Benchmark Assignment so that I can see how you incorporated feedback and improved your understanding of instructional objectives.

Chart for Instructional Objectives

Instructional Objectives

Content Area	Instructional Objective	Bloom's Level	Standards	PA?

Example Assignment 1

Unit
Observing the Weather

Subject
Science

Grade
2

Content Outline

1. Weather
    a. Types of weather conditions
    b. Temperature
2. Data Collection
    a. Thermometers
    b. Data records
    c. Charts
3. Scientific Method
    a. Predictions
    b. Evidence

Standards
From the Arizona Department of Education website (http://www.ade.state.az.us/standards/science/articulated.asp):

Strand 1: Inquiry Process

- Concept 1: Observations, Questions, and Hypotheses
    - PO 2. Predict the results of an investigation (e.g., in animal life cycles, phases of matter, the water cycle).
- Concept 2: Scientific Testing (Investigating and Modeling)
    - PO 1. Demonstrate safe behavior and appropriate procedures (e.g., use of instruments, materials, organisms) in all science inquiry.
    - PO 2. Participate in guided investigations in life, physical, and Earth and space sciences.
    - PO 3. Use simple tools such as rulers, thermometers, magnifiers, and balances to collect data (U.S. customary units).
    - PO 4. Record data from guided investigations in an organized and appropriate format (e.g., lab book, log, notebook, chart paper).
- Concept 3: Analysis and Conclusions
    - PO 1. Organize data using graphs (i.e., pictograph, tally chart), tables, and journals.
    - PO 3. Compare the results of the investigation to predictions made prior to the investigation.

Strand 6: Earth and Space Science

- Concept 3: Changes in the Earth and Sky
    - PO 1. Measure weather conditions (e.g., temperature, precipitation).
    - PO 2. Record weather conditions (e.g., temperature, precipitation).
    - PO 4. Analyze the relationship between clouds, temperature, and weather patterns.

Instructional Objectives

Content Area	Instructional Objective	Bloom's Level	Standards	PA?
1. Weather	1.1 – SWBAT identify different weather conditions (sunny, rainy, cloudy, etc).	Knowledge	S6C3PO1, S6C3P02, S6C3P03	
	1.2 - Explain the relationship between temperature and weather conditions.	Comprehension	S6C3PO4	
2. Data Collection	2.1 - Correctly use a thermometer to determine temperature within 1 degree.	Application	S1C2PO1, S1C2PO2, S1C2PO3, S6C3PO1	yes
	2.2 – Record temperature changes in a notebook.	Application	S2C2PO4, S6C3PO2	
	2.3 – Create a chart showing the weather conditions for the week.	Synthesis	S1C2PO2, S1C3PO1	yes
3. Scientific Method	3.1 - Predict weather based on data collected.	Analysis	S1C2PO2, S1C3PO3, S6C3PO4	yes
	3.2 - Evaluate predictions based on evidence.	Evaluation	S1C1PO2, S1C2PO2	

APPENDIX F

Semester 2: Homework Assignment 2
Test Items
(10 points – Due October 14)

Guiding Question:
How can you write test questions that align with your classroom instructional objectives and measure student learning?

Please submit your assignment to the d2L dopbox by 11am on October 14 OR print your assignment and a copy of the grading rubric (on d2L) and give them to me at the beginning of class.

Late assignments may be submitted via email for half credit for one week following the initial deadline. If you are absent the day assignment 2 is due, you are expected to submit your assignment via email BEFORE the start of your class. Assignments submitted after class has begun will be considered late.

General: The purpose of this assignment is to assess your understanding and application of skills required for writing summative assessments. You will construct **THREE DIFFERENT TYPES** of assessment items based on your IOs from Assignment 1. You will also submit scoring criteria for your assessment items. I will provide formative feedback on this assignment. In other words, you can and should revise this assignment prior to submitting it as part of your Benchmark Assignment for summative evaluation.

Considerations:

- Refer to the example assignment for one idea for format. Not all assignments will fit this general format. If you have concerns, contact the instructor immediately.
- Make sure that your name is on your assignment.
- Please type this assignment and make full use of spell check/grammar check features.
- In order to be compliant with the EdP Plagiarism policy, be sure to note where you found any outside source material. This includes state department of education websites detailing standards and any source of assessment item ideas (including teachers and peers).
- **Include a copy of the assignment 2 rubric with your assignment.**

Grading: In addition to whether you met the requirements described above, you will be assessed on strength of the match between your items and the instructional objectives. As always, be sure the vocabulary and the items are appropriate for the grade you have chosen.

Instructions:

1. Indicate the grade level, unit, and content area of your unit.

2. Select one or more instructional objectives from Assignment 1 that will be covered by the assessment items you write and include them with Assignment 2. If necessary, revise the instructional objectives prior to including them with this assignment.
    a. You may pick 3 different instructional objectives or write multiple items to fully cover 1-2 instructional objectives.
3. Write 3 DIFFERENT TYPES of assessment items. Write the items as they would be presented to students. If you would present the task orally (e.g., for students who are too young to read), include a "script" for what you would say.
    a. You may choose to write multiple choice (lower-level or higher-level cognitive skills, matching, true/false, fill-in-the-blank, short answer, or restricted response items, but you must demonstrate the ability to write 3 different types.
    b. You must follow the guidelines presented in class and in your text in writing your items.
4. Include appropriate directions for each item type.
5. Make sure each item type is formatted appropriately.
6. For each item, indicate the item type, which instructional objective it measures and the cognitive level of the item. Be sure that the cognitive level of the item matches the cognitive level of the instructional objective.
7. Write scoring criteria for each of your items.
    a. For selected response items (multiple choice, matching, true/false), scoring criteria will consist of an "answer key".
    b. For constructed response items (fill-in-the-blank, short answer, restricted response), scoring criteria should be relatively brief and objective. You do not need to write rubrics.
    c. Your points/weights should appropriately reflect the content. Double check that points/weights add up to the totals indicated.

Relationship to Benchmark Assignment:
Assignment 2 is the second component of your Benchmark Assignment. As such, you will be asked to resubmit this assignment (the graded paper) with your Benchmark Assignment so that I can see how you incorporated the feedback provided and improved your understanding of writing test items.

I have included a Reflection Worksheet with this component of the Benchmark Assignment. *You do not need to submit the worksheet to me now*, but it is a good idea to use the worksheet to make notes relevant to the Reflection you will submit with your Benchmark Assignment. Each student will write his/her own reflection (even if he/she is working with a group to complete the project), so it is a good idea to keep your own notes.

Reflection Worksheet

What things did I feel confident about for Assignment 2?

What things did I feel were difficult?

Why do I think I was asked to do this assignment?

In what ways will this experience help me?

Example Assignment 2

Unit
Observing the Weather

Subject
Science

Grade
2

Instructional Objectives

Content Area	Instructional Objective	Bloom's Level	Standards	PA?
1. Weather	1.1 - Identify different weather conditions (sunny, rainy, cloudy, etc).	Knowledge	S6C3PO1, S6C3P02, S6C3P03	
	1.2 - Explain the relationship between temperature and weather conditions.	Comprehension	S6C3PO4	

Items

Directions: Circle the correct answer.

1. Which season is sunny and hot?

   A. spring
   B. summer*
   C. fall
   D. winter

Item 1 is a multiple choice item. It measures IO 1.2: comprehension. The keyed response is B.

Directions: use your vocabulary to complete the sentences.

2. When water falls from the sky, the weather is _____.

Item 2 is a fill-in-the blank item. It measures IO 1.1: knowledge. The keyed response is "rainy". "Rain" is also an acceptable response. Full credit only.

Directions: Read the sentence and decide if it is "right" or "wrong". Circle the correct answer.

3. It feels cold when it snows. Right Wrong

Item 3 is a true/false item. It measures IO 1.2: comprehension. The keyed response is "Right".

APPENDIX G

Semester 2: Homework Assignment 3
Performance Assessment
(10 points – Due November 4)

Assignment Guiding Question:
How can you design a performance assessment and a corresponding scoring method to accurately measure student learning/progress toward instructional objectives?

Please print your assignment and a copy of the grading rubric (on d2L). Attach them and give them to me at the beginning of class.

Late assignments may be submitted via email for half credit for one week following the initial deadline. If you are absent the day assignment 3 is due, you are expected to submit your assignment via email BEFORE the start of your class. Assignments submitted after class has begun will be considered late.

General: The purpose of this assignment is to assess your understanding and application of writing the task and grading criteria for a formal performance assessment. You will write the task for the performance assessment, directions to be given to students, and scoring criteria. I will provide formative feedback on this assignment. In other words, you can and should revise this assignment prior to submitting your Benchmark Assignment for summative evaluation.

Considerations:

- Refer to the example assignment for one idea for format. Not all performance assessments will fit this general format. If you have concerns, contact the instructor immediately.
- Please type this assignment and that you make full use of spell check/grammar check features.
- In order to be compliant with the Ed P Plagiarism policy, be sure to note where you found any outside source material. This includes state department of education websites detailing standards and any source of lesson plan ideas (including teachers and peers).
- **Include a copy of the assignment 3 rubric with your assignment.**

Grading: In addition to whether you met the requirements laid out in these instructions, you will be graded on the strength of the match between your task and the scoring criteria.

Instructions:

1. Indicate the grade level, unit, and content area of your unit.
2. Select one or more instructional objectives from Assignment 1 that will be covered by your performance assessment and include them with Assignment 3. If necessary, revise the instructional objectives prior to including them with this assignment.
3. Write the performance assessment task (assignment sheet), as it would be presented to students. Include all directions, necessary components, requirements, and general grading criteria. Be sure the vocabulary you use and the task itself are appropriate for the grade you have chosen. If you would present the task orally (e.g., for students who are too young to read), include a "script" for what you would say.
4. Write scoring criteria. You may use whichever type of formal scoring criteria that best fits your performance assessment (e.g., a checklist, rating scale, holistic or analytic rubric, or some combination). You must follow the guidelines presented in class and in your text in designing the scoring criteria.
    a. Your points/weights should appropriately reflect the content. Double check that points/weights add up to the totals indicated.
    b. Make sure that descriptions used in your scoring criteria are consistent and appropriately reflect the directions and content.

Relationship to Benchmark Assignment:

Assignment 3 is the third component of your Benchmark Assignment. As such, you will be asked to resubmit this assignment (the one I graded) with your Benchmark Assignment so that I can see how you incorporated the feedback provided and improved your understanding of writing test items.

I have included a Reflection Worksheet with each component of the Benchmark Assignment. **You do not need to submit the worksheet to me now**, but it is a good idea to use the worksheet to make notes relevant to the Reflection you will submit with your Benchmark Assignment. Each student will write his/her own reflection (even if he/she is working with a group to complete the project), so it is a good idea to keep your own notes.

Reflection Worksheet

What things did I feel confident about for Assignment 3?

What things did I feel were difficult?

Why do I think I was asked to do this assignment?

In what ways will this experience help me?

Example Assignment 3

Unit
Observing the Weather

Subject
Science

Grade
2

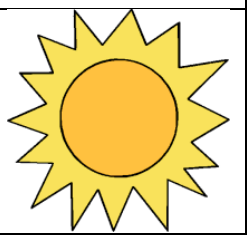
Instructional Objectives

Content Area	Instructional Objective	Bloom's Level	Standards	PA?
1. Weather	1.1 - Identify different weather conditions (sunny, rainy, cloudy, etc).	Knowledge	S6C3PO1, S6C3P02, S6C3P03	
2. Data Collection	2.3 – Create a chart showing the weather conditions for the week.	Synthesis	S1C2PO2, S1C3PO1	yes

Name: _____

Directions:

Fill in the chart showing this week's weather. Make sure you look back at the notes in your lab notebook. You should write the temperature for each day in the chart. Then you should write one word that describes the weather that day. You can also draw a picture to show what the weather was like for each day. Here's an example:

	Monday
Temperature	85°
Today the weather was:	sunny
Weather Picture	

Remember to double check your notebook to make sure you write down the temperature and weather correctly. You can ask the other children at your table for help if you missed a day or forgot to write down the temperature or weather.

	Monday	Tuesday	Wednesday	Thursday	Friday
Temperature					
Today the weather was:					
Weather Picture					

Weather Chart Holistic Rubric:

Excellent Job!	You know how to record temperature in degrees and most (at least 4) temperatures are recorded correctly. You used your weather words correctly and most weather descriptions are correct and spelled right. Your pictures mostly match your descriptions.
Good Work!	You are learning how to record temperature in degrees and some (2-3) temperatures are recorded correctly. You are learning the weather words and how to use them correctly. There are a few mistakes in choosing descriptions or in spelling. A few pictures may not be match your description.
Keep Trying!	You should practice how to record temperatures in degrees and try to find your mistakes. Practice the weather words. You can double check descriptions, spelling, and pictures with table mates.

APPENDIX H

Semester 2: Benchmark Assignment
Sample Comprehensive Assessment Plan
(120 points – Due November 18)

Please submit your assignments and reflections **IN ONE DOCUMENT** via d2L or print your assignments and reflections and give them to me at the beginning of class on November 18th.

Late assignments may be submitted via email for half credit for one week following the initial deadline. If you are absent the day the benchmark assignment is due, you are expected to submit your assignment via email BEFORE the start of your class. Assignments submitted after class has begun will be considered late.

General: The purpose of this project is to assess your understanding and application of skills required for writing assessment materials. Over the course of the semester, you have written instructional objectives (Assignment 1), a table of specifications/test blueprint, summative assessment items, and scoring criteria (Assignment 2), and performance assessments and scoring criteria (Assignment 3). You will now have a chance to revise these components as well as reflect on how your assessment skills have improved over the course of the semester. This is a summative assessment and you will not have another chance to revise your work for this class. Please do take my feedback over the semester to heart when you review your previous assessments. I am happy to meet with you if you have questions. ***Early submissions will be accepted.***

Considerations:

- Carefully read and follow the instructions included here and with the other assignments. Remember you will not have another chance to revise.
- Please highlight all revisions/corrections in yellow on each revised assignment.
- The course project must be typed and each component must follow the format set in the assignments posted to d2l.
- Correct grammar and spelling is expected. Make full use of spell check/grammar check features. Proofread before you submit.
- In order to be compliant with the Ed P Plagiarism policy, be sure to note where you found any outside source material. This includes state department of education websites detailing standards and any source of assessment item ideas (including teachers and peers).

Grading: In addition to whether you met the requirements laid out in these instructions, you will be graded on the strength of the match between your components and the instructional objectives. As always, be sure anything you present to students is written using appropriate vocabulary and formatting for the grade you have chosen. Anything you present must demonstrate the level of writing expected of you as a professional.

Instructions:

5. Include the revised and graded versions of Assignment 1. Refer to the assignment sheet posted to d2l for details, but be sure to include:
    a. Grade level, subject area, and content topic
    b. Content outline
    c. State standards related to the content you will cover
    d. Well-written instructional objectives
    e. Documentation of the Bloom's level of each instructional objective
    f. Documentation of the match between your instructional objectives and the state standards you have chosen
    g. Highlight revisions/corrections in yellow on revised assignment 1
6. Include the revised and graded versions of Assignment 2. Refer to the assignment sheet posted to d2l for details, but be sure to include:
    a. Well-written instructional objective(s) that are the focus of your assessment items
    b. Assessment items that match the level and content of your instructional objectives
    c. Highlight revisions/corrections in yellow on revised assignment 2
7. Include the revised and graded versions of Assignment 3. Refer to the assignment sheet posted to d2l for details, but be sure to include:
    a. Well-written instructional objective(s) that are the focus of your performance assessment
    b. Performance assessment task (including all directions, necessary components, requirements, and general grading criteria)
    c. Formal scoring criteria
    d. Highlight revisions/corrections in yellow on revised assignment 3
8. Write a reflection of your experience compiling the assessment materials for your unit. Review the reflection worksheets you completed throughout the semester to help organize your reflection. **Reflections should be written as essays and include all of the following components:**
    a. Your subjective impressions/ratings of how much you feel you have improved your learning from the first to the final submission of each component. Note that means you need to specifically discuss your learning experience for EACH of the assignments.
    b. Evaluation of what skills represented by components of the course project are your strengths and what you plan to do to maintain these skills
    c. Evaluation of what skills represented by components of the course project are your weaknesses and what you plan to do to improve them
    d. Discussion of what you have learned this semester that you plan to incorporate into your teaching and why
    e. Discussion of what you have learned this semester that you do not plan to incorporate into your teaching and why
    f. Statement of your personal, classroom assessment philosophy. How will you use assessment to drive your instruction and make instructional decisions? What do you want to teach your students about assessment? How do you want them to view classroom assessment?

APPENDIX I

Semester 1: Case Study Part 1 Rubric

	4	3	2	1	0
Basic information	Includes student name, age, and grade level in complete sentences.	Includes name, age, and grade level in bullet points or incomplete sentences.	Two of the following are included: name, age, and grade level.	Only one of the following is included: name, age, and grade level.	Missing
Academic performance	Includes specific information about how the student is performing academically as compared to their peers.	Includes general information about how the student is performing academically as compared to their peers. Specific details are needed.	Includes some general information about how the student is performing academically, but does not provide a comparison to their peers.	Generally mentions academic performance but does not include specific details or a comparison to their peers.	Missing
Likes/dislikes	Includes detailed information about what the student likes and dislikes in school.	Includes information about what the student likes and dislikes in school. More information is needed.	Includes information about what the student likes and dislikes in school, but is unclear/difficult to understand.	Includes information about either what the student likes or dislikes.	Missing
Physical development	Development of both fine and gross motor skills is presented with evidence/examples of each.	Development of both fine and gross motor skills is presented with some evidence/examples. More detailed information is needed.	Development of fine and gross motor skills is presented but information is incorrect (ex: fine and gross motor skills are mixed up).	Development of fine and gross motor skills is mentioned. No evidence or examples are provided.	Missing
Other informatio	Other pertinent/import	Other pertinent/import	Other information	Other informatio	Missing

n	ant information is presented in a clear and concise manor.	ant information is presented but is not in complete sentences or lacks sufficient detail.	is presented but is unclear/difficult to understand.	n is mentioned, but may not be relevant or is incomplete.	

General feedback/notes:

Total Score _____/20

APPENDIX J

Semester 1: Case Study Part 2 Rubric

	4	3	2	1	0
Discussion of theory	Major concepts related to the selected theory are presented/discussed in relation to the student accurately. Clear evidence of your understanding of the selected theory is present and can apply the theory to your case study student.	Most major concepts related to the selected theory are presented/discussed in relation to the student accurately (1-2 minor errors are present). You present evidence showing an understanding of the major points of the theory, but may have some minor misunderstandings.	Some major concepts related to the selected theory are presented/discussed in relation to the student accurately (3-4 minor errors are present). There is evidence that you understand portions of the theory, but have difficulty applying it accurately to your case study student.	Major concepts related to the selected theory are presented/discussed but are inaccurate. Evidence supporting a clear understanding of the theory and the ability to apply the theory to your student is lacking.	Missing
Development as related to selected theory	The development of the student is directly connected to the selected theory. Discussion and connections are accurate and clear.	The development of the student is directly connected to the selected theory. Discussion and connections are accurate and clear.	The development of the student is directly connected to the selected theory. Discussion and connections are accurate and clear.	An attempt was made to connect the student's development to the theory, but is incorrect or incomplete.	Missing
Explanation of development	Explanation for why you believe the student's cognitive development is or is not age	Explanation for why you believe the student's cognitive development is or is not age	Explanation for why you believe the student's cognitive development is or is not age	An attempt was made to explain why or why not you believe the student's cognitive	

	appropriate provided. Explanation is reasonable and clear.	appropriate provided. Explanation needs further detail/support.	appropriate provided. Explanation needs further detail/support and parts are inaccurate.	development is or is not age appropriate. Explanation may be difficult to follow, incomplete or inaccurate.	
Evidence of development	Specific examples are presented supporting the claims made in relation to the developmental theory. Examples are clear and concise.	Specific examples are presented supporting the claims made, but need more supporting information/details.	General examples are given. Examples lack specificity and supporting information/detail.	An attempt was made at providing examples, but examples may lack clarity or be inaccurate representations of the selected theory.	Missing

General feedback/notes:

Total Score _____/20

APPENDIX K

Semester 1: Case Study Part 3 (Final Paper) Rubric

General Requirements (1 point each)
_____Basic information about the student is included (name, age, and grade level)
_____Specific information about academic performance is included.
_____Student likes/dislikes related to school are included.
_____Other pertinent information about the student is included.

Physical Development:

	4	3	2	1	0
Physical development	Development of both fine and gross motor skills is presented with evidence/examples of each.	Development of both fine and gross motor skills is presented with some evidence/examples. More detailed information is needed.	Development of fine and gross motor skills is presented but information is incorrect (ex: fine and gross motor skills are mixed up).	Development of fine and gross motor skills is mentioned. No evidence or examples are provided.	Missing

Cognitive Development:

	4	3	2	1	0
Discussion of theory	Major concepts related to the selected theory are presented/discussed in relation to the student accurately. Clear evidence of your understanding of the selected theory is present and can apply the theory to your	Most major concepts related to the selected theory are presented/discussed in relation to the student accurately (1-2 minor errors are present). You present evidence showing an understanding of the major points of the	Some major concepts related to the selected theory are presented/discussed in relation to the student accurately (3-4 minor errors are present). There is evidence that you understand portions of the theory, but have difficulty	Major concepts related to the selected theory are presented/discussed but are inaccurate. Evidence supporting a clear understanding of the theory and the ability to apply the theory to your student is lacking.	Missing

	case study student.	theory, but may have some minor misunderstandings.	applying it accurately to your case study student.		
Development as related to selected theory	The development of the student is directly connected to the selected theory. Discussion and connections are accurate and clear.	The development of the student is connected to the selected theory. Discussion and connections are mostly accurate and clear (1-2 minor errors are present).	The development of the student is somewhat connected to the selected theory. Discussion and connections may be lacking detail or are inaccurate (3-4 errors are present).	An attempt was made to connect the student's development to the theory, but is incorrect or incomplete.	Missing
Explanation of development	Explanation for why you believe the student's cognitive development is or is not age appropriate provided. Explanation is reasonable and clear.	Explanation for why you believe the student's cognitive development is or is not age appropriate provided. Explanation needs further detail/support.	Explanation for why you believe the student's cognitive development is or is not age appropriate provided. Explanation needs further detail/support and parts are inaccurate.	An attempt was made to explain why or why not you believe the student's cognitive development is or is not age appropriate. Explanation may be difficult to follow, incomplete or inaccurate.	Missing
Evidence of development	Specific examples are presented supporting the claims made in relation to the developmental theory. Examples are clear and concise.	Specific examples are presented supporting the claims made, but need more supporting information/details.	General examples are given. Examples lack specificity and supporting information/detail.	An attempt was made at providing examples, but examples may lack clarity or be inaccurate representations of the selected theory.	Missing

Social/Emotional Development:

	4	3	2	1	0
Identity and Self	You discussed your student's temperament using 1 of Chess & Thomas's 3 types of temperament as well as your student's self-concept, self-esteem, and self-efficacy as a student. Clear evidence of your understanding of each element and your ability to apply each element to your case study student is present.	You discussed your student's temperament using 1 of Chess & Thomas's 3 types of temperament as well as 2 of the following in relation to your student: self-concept, self-esteem, and self-efficacy. Most major concepts are presented/discussed in relation to the student accurately (1-2 minor errors may be present).	You discussed your student's temperament but may not have tied it to 1 of Chess & Thomas's 3 types of temperament. 1 of the following is discussed in relation to your student: self-concept, self-esteem, and self-efficacy. Some major concepts are presented/discussed in relation to the student accurately (3-4 minor errors may be present).	1 of the following is discussed in relation to your student: temperament, self-concept, self-esteem, or self-efficacy. Major concepts are presented/discussed but are inaccurate. Evidence supporting a clear understanding of these elements and the ability to apply them to your student is lacking.	Missing
Emotions and interactions	Explanation for how you believe the student's emotional interactions are impacted by their	Explanation for how you believe the student's emotional interactions are impacted by their emotional intelligence and regulation	Explanation for how you believe the student's emotional interactions are impacted by their emotional intelligence and regulation	An attempt was made to explain how you believe the student's emotional interactions are impacted by their emotional intelligence and	Missing

	emotional intelligence and regulation is reasonable and clear.	needs further detail/support.	needs further detail/support and parts are inaccurate.	regulation. Explanation may be difficult to follow, incomplete or inaccurate.	
Motivational development	The development of the student is directly connected to the selected theory. Discussion and connections are accurate and clear.	The development of the student is connected to the selected theory. Discussion and connections are mostly accurate and clear (1-2 minor errors are present).	The development of the student is somewhat connected to the selected theory. Discussion and connections may be lacking detail or are inaccurate (3-4 errors are present).	An attempt was made to connect the student's development to the theory, but is incorrect or incomplete.	Missing
Evidence of motivational development	Specific examples are presented supporting the claims made in relation to the motivational theory. Examples are clear and concise.	Specific examples are presented supporting the claims made, but need more supporting information/details.	General examples are given. Examples lack specificity and supporting information/detail.	An attempt was made at providing examples, but examples may lack clarity or be inaccurate representations of the selected theory.	Missing

Classroom Recommendations:

	4	**3**	**2**	**1**	**0**
Classroom recommendations	Appropriate recommendations for the classroom are given	Recommendations for the classroom are given based upon the	Recommendations for the classroom are given based upon the	Recommendations for the classroom are given based upon the	Missing

	based upon the information gathered that are exceptionally insightful. Critical conclusions and connections between theories and observations have been made.	information gathered and are somewhat insightful. An attempt to draw critical conclusions and make connections between theories and observations has been made.	information gathered and are clear but need more insight. Clearer conclu sions and connections between theories and observations need to be made.	information gathered but lack insight . Conclusions and connections between theories and observations are weak.	

General feedback/notes:

Total Score _____/44

APPENDIX L

Semester 1: Case Study Presentation Rubric

Criteria	4	3	2	1
Knowledge / Understanding	– evidence of clear understanding of physical, cognitive, and social emotional developmental theories - knowledge of theories is exceptionally accurate and is explained clearly and effectively	- evidence of clear understanding of 2 of the 3 developmental areas - knowledge of most theories is accurate and explained clearly and effectively	- evidence of clear understanding of 2 of the 3 developmental areas - theories are explained with some accuracy but need more details	- evidence of clear understanding of 1 or fewer developmental areas - theory explanations need more accurate information and details
Thinking /Inquiry	- exceptional critical comments and analysis of student / interpretations and impact/effect of development / supported by specific examples	-proficient critical comments and analysis of student development /interpretations and impact supported by some examples	-some critical comments given about student and effects on development - more details/ critical thought needed in presenting and interpreting examples	-lack of critical or analytical thought in comments about student development - more details/ critical thought needed in presenting and interpreting examples
Application	- appropriate recommendations for the classroom are given based upon the information gathered - recommendations are exceptionally insightful -	- recommendations for the classroom are given based upon the information gathered - recommendations are somewhat insightful -	- recommendations for the classroom are given based upon the information gathered - recommendations are clear but need more insightful -	- recommendations for the classroom are given based upon the information gathered - recommendations lacked any insight - weak conclusions and

	presenter makes critical conclusions and connections between theories and observations	presenter attempts to draw critical conclusions and make connections between theories and observations	presenter needs to make clearer conclusions and connections between theories and observations	connections between theories and observations
Communication	-exceptional delivery, speaking is clear and easy to understand -presentation falls within the 10 minute time limit -visual aid is exceptionally detailed, organized, logical and easy to follow/understand	-proficient delivery, speaking is mostly clear and easy to understand OR -presentation exceeds 10 minute time limit - visual aid is detailed, organized, logical and easy to follow/understand	-delivery of information is difficult to understand/follow OR - visual aid is somewhat organized and needs more detail or is difficult to follow -presentation exceeds 10 minute time limit	- delivery of information is difficult to understand/follow AND - visual aid is somewhat organized and needs more detail or is difficult to follow -presentation exceeds 10 minute time limit
Avg. Score _____ **Final Percentage Score _____**				

APPENDIX M

Semester 2: Assignment 1 Rubric

Rubric (point values indicated)

	1	**.75**	**.5**	**.25**	**0**
Content Outline (CO)	CO meets 3 requirements: a) Short/narrow enough for this project b) Well-organized c) Appropriate for the grade level	CO meets 2 requirements. Please work on requirement:	CO meets 1 requirement. Please work on requirements:	CO is unclear. Further feedback cannot be provided.	CO is missing.
State or Common Core standards (SS)	SS meets 3 requirements: a) Include both content standard and benchmarks b) Appropriate for the content area c) Source is indicated	SS meets 2 requirements. Please work on requirement:	SS meets 1 requirement. Please work on requirements:	SS are unclear. Further feedback cannot be provided.	SS are missing.
Organization of Instructional Objectives (OIO)	OIO meets 3 requirements: a) Completely covers the content outline b) Appropriately matches the indicated content. c) Sufficiently narrows or redefines state standards when necessary	OIO meets 2 requirements. Please work on requirement:	OIO meets 1 requirement. Please work on requirements:	OIO is unclear. Further feedback cannot be provided.	OIO is missing.
Deconstruction of	All state/Common Core standards have	1-2 standards	3-4 standards	5 or more	None of the

state/Common Core Standards	been appropriately broken down into observable and measureable instructional objectives.	need to be broken down into further detail.	need to be broken down into further detail.	standards need to be broken down into further detail.	standards included have been broken down to form appropriate IOs.
Writing of Instructional Objectives (IOs)	All IOs are well-written and conform to criteria presented in class (e.g., are student-centered, observable, appropriate in specificity, not activities, not double-barreled)	1-2 IOs need work.	3-4 IOs need work.	5 or more IOs need work.	IOs are missing.
Bloom's Level (BL)	All BL seem accurate.	1-2 BL seem inaccurate.	3-4 BL seem inaccurate.	5 or more BL seem inaccurate.	BL are missing.
Match to State/Common Core Standards (MSS)	All MSS seem accurate.	1-2 MSS seem inaccurate.	3-4 MSS seem inaccurate.	5 or more MSS seem inaccurate.	MSS are missing.

Checklist

- _____Student followed assignment directions (1 point if checked – no grade assigned if not checked.)
- _____ Assignment follows designated format. (1 point if checked)
- _____ Spelling and grammar are appropriate. (1 point if checked - deduct 10-30% credit from overall assignment as appropriate)

Total Score /10

General feedback/notes:

APPENDIX N

Semester 2: Assignment 2 Rubric

Assignment 2 is worth 10 points.

Checklist (1 points per item)

- _____ Assignment is typed.
- _____ Ed P Plagiarism Policy is followed.
- _____ Spelling and grammar are appropriate.
- _____ Grade level, unit, and content area are indicated.

Rubric (point values indicated)

	1	0.75	0.5	0.25	0
Instructional Objectives (IOs)	IOs/revisions are: d) included e) well written f) have appropriate Bloom's level indicated	IOs meet 2 requirements. Please work on requirement:	IOs meet 1 requirement. Please work on requirements:	IOs are unclear. Further feedback cannot be provided.	IOs are missing.
Assessment Items (AI)	AI meets 3 requirements: d) 3 different item types are included e) Format is appropriate f) Directions are well written	AI meets 2 requirements. Please work on requirement:	AI meets 1 requirement. Please work on requirements:	AI are unclear. Further feedback cannot be provided.	AI are missing.
Item Writing (IW)	All items are well-written and conform to criteria presented in class and in the text.	1 item needs revision.	2 items need revision.	3 items need revision.	Items are missing.
Scoring criteria (SC)	All items are well-written and conform to criteria presented in class and in the text (selected response items have	1 SC needs work.	2 SC need work.	3 SC need work.	SC are missing.

	keys, constructed response items have objective criteria, points/weights are appropriate).				
IO match to content	All items and IOs match in content.	1 match needs revision.	2 matches need revision.	3 matches need revision.	Match information is missing.
IO match to cognitive level	All items and IOs match in cognitive level.	1 match needs revision.	2 matches need revision.	3 matches need revision.	Match information is missing.

Total_____/10
Comments:

APPENDIX O

Semester 2: Assignment 3 Checklist

Checklist for Assignment 3 (worth 10 points)

General Formatting Issues (10%)

- _____ Assignment is typed.
- _____ Ed P Plagiarism Policy is followed.
- _____ Spelling and grammar are appropriate.

Score is _____ /3 X 100= _____% x .01 = _____

Instructional Objectives (10%)

- _____ IOs/revisions are clear and well-written.
- _____ IOs/revisions have appropriate bloom's level indicated.

Score is _____ /2 X 100= _____% x .01 = _____

PA choice (15%)

- _____ PA is authentic.
- _____ PA is realistic (in terms of practical limitations).
- _____ PA references a learning goal (and is not just an activity).

Score is _____ /3 X 100= _____% x .015 = _____

Task Directions (25%)

- _____ Directions are clear and well-written.
- _____ Vocabulary is appropriate for student level.
- _____ Expectations/requirements and general grading are included.
- _____ Access to resources/external components/examples are indicated.

Score is _____ /4 X 100= _____% x .025 = _____

Scoring Criteria (25%)

- _____ Scoring criteria is clear and well-written.
- _____ Choice of scoring criteria is appropriate to task/grade.
- _____ Descriptions are consistent/parallel.
- _____ Points/weights appropriately reflect content and instructional objectives.

Score is _____ /4 X 100= _____% x .025 = _____

Match between Task and Scoring Criteria (15%)

- _____ Task completely covers the instructional objectives indicated.
- _____ Task design allows students to demonstrate mastery of content.

Score is _____ /2 X 100= _____% x .015 = _____

Total Score _____/10

Comments:

APPENDIX P

Semester 2: Benchmark Assignment Rubric

Benchmark Assignment is worth 120 points.

Reflection Paper Rubric (30 points)

Score	Learning	Strengths	Weaknesses	Use/Not Use	Assessment Philosophy
6	Discussion of learning for each of the 3 assignments, includes specific explanations.	Evaluation of at least 2 strong skills related to the assignments with discussions of how to maintain all	Evaluation of at least 2 weak skills related to the assignments with discussions of how to improve all	Clear explanation of specific learning that will **AND** will not be used in future and why	States how assessment will be used in the classroom, how it will drive instruction, what students will be taught, and how students should view assessment
5	Incomplete or nonspecific for 1 assignment	Lacking how to maintain one skill	Lacking how to maintain one skill	Explanation not specific to skills or learning	All areas addressed but lacking clarity or specificity.
4	Missing for one assignment	Skills do not match assignments	Skills do not match assignments	Some discussion, not all examples include why	Three areas addressed clearly and specifically.
3	Incomplete or nonspecific for 2	Included only one skill	Included only one skill	No explanation of why or only discusses what will be used **OR** not used	Two areas addressed clearly and specifically or three areas that lack clarity or specificity.
2	Missing two	Lacking how to maintain two or more	Lacking how to improve two or more	Vague description	Less than two areas addressed or two areas that lack clarity and specificity.
1	Incomplete or	Vague or incomplete	Vague or incomplete	Incomplete	Vague overall, none of the four

	nonspecific for all				areas addressed.
0	Not done	Not done	Not done	Not done	Not done
Comments					

Reflection Essay Grade

_____/4 Spelling, Grammar, and Overall Clarity of Reflection Paper (partial available)

_____/30 Reflection Essay Rubric from above

Course Project Checklist

_____/2 Components/revised assignments are attached.

_____/3 Graded copy of Assignment 1 is included (1 point for nongraded)

_____/3 Graded copy of Assignment 2 is included (1 point for nongraded)

_____/3 Graded copy of Assignment 3 is included (1 point for nongraded)

Summary of Revised Assignment Grades

_____/25 Assignment 1 Rubric

_____ /25 Assignment 2 Rubric

_____ /25 Assignment 3 Rubric

Total score

_____/120 Total Course Project Points

APPENDIX Q

Semester 2: Benchmark Assignment 1 Rubric

Rubric (point values indicated)

	4	3	2	1	0
Content Outline (CO)	CO meets 3 requirements: g) Short/narrow enough for this project h) Well-organized i) Appropriate for the grade level	CO meets 2 requirements. Please work on requirement:	CO meets 1 requirement. Please work on requirements:	CO is unclear. Further feedback cannot be provided.	CO is missing.
State standards (SS)	SS meets 3 requirements: g) Include both content standard and benchmarks h) Appropriate for the content area i) Source is indicated	SS meets 2 requirements. Please work on requirement:	SS meets 1 requirement. Please work on requirements:	SS are unclear. Further feedback cannot be provided.	SS are missing.
Organization of Instructional Objectives (OIO)	OIO meets 3 requirements: d) Completely covers the content outline e) Appropriately matches the indicated content. f) Sufficiently narrows or redefines state standards when necessary	OIO meets 2 requirements. Please work on requirement:	OIO meets 1 requirement. Please work on requirements:	OIO is unclear. Further feedback cannot be provided.	OIO is missing.
Writing of Instructional Objectives (IOs)	All IOs are well-written and conform to criteria presented in class (e.g., are student-centered, observable, appropriate in specificity, not	1-2 IOs need work.	3-4 IOs need work.	5 or more IOs need work.	IOs are missing.

	activities, not double-barreled)				
Bloom's Level (BL)	All BL seem accurate.	1-2 BL seem inaccurate.	3-4 BL seem inaccurate.	5 or more BL seem inaccurate.	BL are missing.
Match to State Standards (MSS)	All MSS seem accurate.	1-2 MSS seem inaccurate.	3-4 MSS seem inaccurate.	5 or more MSS seem inaccurate.	MSS are missing.

Checklist

- _____ Assignment follows designated format. (1 point if checked)
- _____ Spelling and grammar are appropriate. (deduct 10-30% credit from overall assignment as appropriate)

Total Score /25

APPENDIX R

Semester 2: Benchmark Assignment 2 Rubric

Checklist (0.25 points per item)

- _____ Assignment is typed.
- _____ Ed P Plagiarism Policy is followed.
- _____ Spelling and grammar are appropriate.
- _____ Grade level, unit, and content area are indicated.

Rubric (point values indicated)

	4	3	2	1	0
Instructional Objectives (IOs)	IOs/revisions are: j) included k) well written l) have appropriate Bloom's level indicated	IOs meet 2 requirements. Please work on requirement:	IOs meet 1 requirement. Please work on requirements:	IOs are unclear. Further feedback cannot be provided.	IOs are missing.
Assessment Items (AI)	AI meets 3 requirements: j) 3 different item types are included k) Format is appropriate l) Directions are well written	AI meets 2 requirements. Please work on requirement:	AI meets 1 requirement. Please work on requirements:	AI are unclear. Further feedback cannot be provided.	AI are missing.
Item Writing (IW)	All items are well-written and conform to criteria presented in class and in the text.	1 item needs revision.	2 items need revision.	3 items need revision.	Items are missing.
Scoring criteria (SC)	All items are well-written and conform to criteria presented in class and in the text (selected response items have keys, constructed response items have	1 SC needs work.	2 SC need work.	3 SC need work.	SC are missing.

	objective criteria, points/weights are appropriate).				
IO match to content	All items and IOs match in content.	1 match needs revision.	2 matches need revision.	3 matches need revision.	Match information is missing.
IO match to cognitive level	All items and IOs match in cognitive level.	1 match needs revision.	2 matches need revision.	3 matches need revision.	Match information is missing.

Total_____/25

APPENDIX S

Semester 2: Benchmark Assignment 3 Checklist

Checklist for Assignment 3 (worth 25 points)

General Formatting Issues (10%)

- _____ Assignment is typed.
- _____ Ed P Plagiarism Policy is followed.
- _____ Spelling and grammar are appropriate.

Score is _____ /3 X 100= _____% x .025 = _____

Instructional Objectives (10%)

- _____ IOs/revisions are clear and well-written.
- _____ IOs/revisions have appropriate bloom's level indicated.

Score is _____ /2 X 100= _____% x .025 = _____

PA choice (15%)

- _____ PA is authentic.
- _____ PA is realistic (in terms of practical limitations).
- _____ PA references a learning goal (and is not just an activity).

Score is _____ /3 X 100= _____% x .0375 = _____

Task Directions (25%)

- _____ Directions are clear and well-written.
- _____ Vocabulary is appropriate for student level.
- _____ Expectations/requirements and general grading are included.
- _____ Access to resources/external components/examples are indicated.

Score is _____ /4 X 100= _____% x .0625 = _____

Scoring Criteria (25%)

- _____ Scoring criteria is clear and well-written.
- _____ Choice of scoring criteria is appropriate to task/grade.
- _____ Descriptions are consistent/parallel.
- _____ Points/weights appropriately reflect content and instructional objectives.

Score is _____ /4 X 100= _____% x .0625 = _____

Match between Task and Scoring Criteria (15%)

- _____ Task completely covers the instructional objectives indicated.
- _____ Task design allows students to demonstrate mastery of content.

Score is _____ /2 X 100= _____% x .0375 = _____

Total Score _____/25

APPENDIX T

Semester 1: Student Satisfaction Survey

Please check the appropriate response using the following scale.

1=strongly disagree; 2=disagree; 3=somewhat disagree; 4=neither agree nor disagree;

5=somewhat agree; 6=agree; 7=strongly agree

	1	2	3	4	5	6	7
1. The instructor allowed students to actively engage in phenomena (i.e. instructor allowed students to freely ask questions, predict and explain phenomena, and interact with classroom materials)							
2. Instructor allowed students to apply their knowledge (i.e. with the use multiple resources such as books, journals, and computers to illustrate information, plan/execute investigations, apply concepts learned to ne situations by connecting old and new ideas, and reflecting on their questions and scientific hypotheses)							
3. Instructors variously assessed students understanding of content and artifacts (both qualitatively and quantitatively)							
4. Student made use of learning communities by expressing their knowledge, debating/explaining reasons for their ideas with their teachers and classmates							
5. Student and instructor focused on driving questions that supported classroom activities							
6. PBL and instruction was motivating for student learning							
7. Classroom materials were appropriate for different learners							
8. Instructors encouraged student learning							
9. Classroom materials and activities encouraged student learning							
10. Instructor supported and scaffolded student learning							

11. Student was able to gain new insight about content through collaboration and sharing of ideas							
12. PBL was helpful for student learning							
13. Generally, the instructor implemented PBL well							
14. Instructional content was well designed							
15. PBL and instruction was helpful in preparing preservice teachers to become teachers							

Additional Comments:

Instructional Satisfaction:
Curriculum Satisfaction:

APPENDIX U

Semester 2: Student Satisfaction Survey

Please check the appropriate response using the following scale.

1=strongly disagree; 2=disagree; 3=neither agree nor disagree; 4=agree; 5=strongly agree

	1	2	3	4	5
1. The instructor allowed me to actively engage in phenomena (i.e. instructor allowed me to freely ask questions, predict and explain phenomena, and interact with classroom materials).					
2. The instructor allowed me to apply my knowledge (i.e. with the use multiple resources such as books, journals, and computers to illustrate information, plan/execute investigations, apply concepts learned to new situations by connecting old and new ideas, and reflecting on their questions and scientific hypotheses).					
3. The instructor variously assessed my understanding of content and artifacts (both qualitatively and quantitatively).					
4. I made use of learning communities by expressing my knowledge and debating/explaining reasons for my ideas with my teachers and classmates.					
5. The instructor and I focused on driving questions that supported classroom activities.					
6. The instruction was motivating for my learning.					
7. Classroom materials were appropriate for my learning.					
8. The instructor encouraged my learning.					
9. Classroom materials and activities encouraged my learning.					
10. The instructor supported and scaffolded my learning.					
11. I was able to gain new insight about content through collaboration and sharing of ideas.					
12. The instruction was helpful for my learning.					
13. Generally, the instructor implemented instruction well.					

14. Instructional content was well designed.					
15. Instruction was helpful in preparing me to become a teacher.					

Additional Comments:

Instructional Satisfaction:
Curriculum Satisfaction:

APPENDIX V

Observation Protocol

First, teachers and students start with a driving question, a topic to be explored, which includes something students are interested in and can solve.
Second, students explore this question and attempt to find answers through constructing their knowledge and ideas through experience • This is the process of problem solving (i.e. similar process to what we do when doing our research/dissertations)
Third, students and teachers work together to find a solution to their driving question • Collaboration is key
Fourth, students are supported and scaffolded through teachers and the use of classroom tools and technology • Here, students need curriculum materials to help support their learning (i.e. journals, computers, papers, anything that will help them build their knowledge).
Fifth, students address their driving questions and findings to the classroom • Here, students also create artifacts or meanings/understandings of their learning. With this, students will finish a final paper of their findings, which means they have *created* some type of project, according to the principles of PBL. Students will also give a presentation. The presentation also fits into this because students must present their findings to their peers

(Blumenfeld et al., 1991; Krajcik et al., 1994)

Researcher's Guiding Questions of Observations/Notes:

1. How well has the instructor followed directions?
    a. What is being followed through?
    b. What is not being followed through (with instructor and students)?
2. What will students gain from the PBL approach?
3. Look at time of lecture versus time of discussion
4. Look at group collaboration (time and quality)

****Overall Observation** notes:**

PBL Group

*Classroom:
*Notes:

Comparison Group

*Classroom:
*Notes:

APPENDIX W

Instructor Interview Protocol

Researchers initial impressions of PBL and instruction: PBL Group: Comparison Group: Both Classes:

Guiding Question: Does the instructor have the same impression of my observations?

Instructional Satisfaction: Is the instructor satisfied with my impression of PBL instruction?
Curriculum Satisfaction: Is the instructor satisfied with my impression of the PBL curriculum?

Instructor Self-Evaluation:

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