Project-Based Learning, Academic Achievement, and Field Dependency: The Effect Project-Based Learning in Higher Education has on Academic Achievement Test Scores and the Correlation between Participants' Academic Achievement Test Scores and their Field Dependency Cognitive Style

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Authorization to Submit Dissertation

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Abstract

Project-based learning (PBL) with information technology guides students to actively participate in constructing knowledge while interacting with peers and the environment. While there is some evidence of the success of PBL in higher education, most PBL research focuses on the effectiveness in K-12 classrooms. Other factors influencing a student's ability to learn in different teaching methods are cognitive styles. Field dependency is a continuum described as a person's ability or inability to rely on contextual cues, social contexts, and internal analytical skills. This study investigated the effects PBL with information technology had on two intact class groups of participants in a higher education course addressing child development, learning theories, and assessment strategies. A quasi-experimental switching replications design was utilized, where both groups participated as the control and the treatment groups for three different instructional units throughout the semester. The control group received lecture instructional style, while the treatment group participated in PBL. A pretest and posttest was administered for each of the three units. Quantitative measures included pre and post academic achievement test scores, PBL project scores, and the Group Embedded Figures Test scores. Participants responded to a reflection questionnaire by stating their perceptions and experiences with PBL and lecture instructional styles. Results suggest PBL with information technology increases academic achievement when compared to lecture instructional style (group 1 $F(1, 83) = 5.54$, $p = .02$; group 2 $F(1, 83) = 4.17$, $p = .04$). Participants' field dependency scores had no significant correlation with their academic achievement scores after engaging in PBL instruction (group 1 ($r(51) = .24$; group 2 ($r(30) = .10$) Indicative of the qualitative reflection questionnaire, participants stated they preferred lecture instructional style, mentioning it is easier, while they described PBL to have more of an impact on their learning and academic achievement. Introducing PBL into higher education instruction was shown to be an effective instructional style for increasing academic achievement.

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Chapter 1: Introduction

Many individuals prefer online computer-based instruction to face-to-face environments, a person may choose to take notes while another may choose to listen, or some would rather study in a group as opposed to individually. There is no doubt that individual differences exists within learning preferences. For years, researchers and theorists have studied the idea of learning styles and cognitive styles (Kolb, 1984; Fleming, 2000; Vygotsky, 1962; Witkin & Goodenough, 1981). Much of what we know about learning and thinking shapes our teaching practices and curriculum. Skinner (1954) suggested individual differences in learners are an important concern in developing and implementing curriculum. Individuals who have been through years of schooling know their personal preference on how they want or need to learn. For example, some people prefer a more one-on-one interactions while others may prefer discussing concepts with others or some prefer to read a text and take a test, whereas others would rather work through a laboratory procedure and create a final product. With many differences in learning, there have been many theories on the best ways to acquire, use, and share knowledge.

As an increasingly accepted philosophy (Willis & Mehlinger, 1996), Constructivism argues for students actively engaging in the construction of their own knowledge with their experiences on contexts (Fosnot & Perry, 1996). Nested in Constructivism, active learning strategies have been developed and researched as ways for students to become active in a more traditional classroom setting. Through active learning strategies, students can develop critical thinking and problem solving skills to make learning as authentic as it can be (Sivan, Leung, Woon, & Kember, 2000). Active learning strategies can be described as "instructional activities involving students in doing things and thinking about what they are

doing" (Bonwell & Eison, 1991). Project-based learning fits this framework, as the process ensures students are actively participating in what they are learning. Teachers using constructivist approaches do not teach with direct instruction, but rather help students to be self-regulatory and encourage them to intrinsically value a deep knowledge through learning. Often "associated with constructivist theory of learning" (Fleming, 2000, p. 4), project-based learning is a direct application of constructing knowledge from interacting with the environment. As a method of active learning, in project-based learning, students are able to create meaning from inquiry and problem solving while creating a project. This idea will not only aid them in the learning of current material, but provide skills for learning in future classes. Students will acquire more knowledge and find more motivation and enjoyment in those courses that prompt them to be active (Lawson, 1995; Watson, Kessler., Kallas, Kam, & Ueki, 1996).

There may be other factors that influence a student's ability to learn in different teaching methods including their personal preferences. Witkin, Oltman, Raskin, and Karp (1971) define cognitive style as "the characteristic, self-consistent patterns of organizing and processing information or the modes functioning which individuals show in their perceptual and intellectual activities" (p. 3). Relating to Witkin's definition of cognitive styles, Messick (1976) also described cognitive styles as "consistencies in the manner or form of cognition…[which] extends to almost all human activities that implicate cognition, including social and interpersonal functioning" (p.5). Individuals with different cognitive or thinking styles, have different academic needs in which their environment can directly affect a success or failure due to a necessity of a different environment.

As a cognitive style, field dependency may affect learning based on what type of learning and resources are available. Those who are labeled field independent are analytical and tend to rely on internal problem solving skills while those labeled field dependent rely on contextual cues and social contexts for information. This difference can greatly affect the academic achievement in different contexts. Individuals may benefit more from a social, cooperative learning format if they fit the criteria for being field dependent and someone who is more field independent might excel better when asked to complete a project individually that required efficient critical thinking and problem solving skills. There is little literature describing the connection of project-based learning and cognitive styles with academic achievement, especially in higher education and more specifically with preservice teachers. This proposed study may help to fill this gap and add to the theoretical, practical, and conceptual understandings of aforementioned concepts.

Statement of Problem

Education systems should consider the experiences and needs of its students and to support them through their learning processes. In making concepts relevant to student lives, there are many resources to use including, technology, culture, experience, teaching strategies, etc. Competing with traditional teaching methods, the expansion and availability of technology has been a major change into today's society. Prensky (2001) discusses that "today's learners are truly different, and training and education have not kept pace with them. Moreover, training and education are largely nonmotivating or demotivating to the Games Generation. So, we should ask, how *can* we motivate today's learners?" (p. 100).

Students are a direct result of what learning has occurred in the classroom, in which case it is necessary to understand how students are learning and the impact that curriculum

and pedagogy have on academic achievement. Gentilucci (2004) stresses the need to research subjectively in student perceptions of their learning. If researchers and teachers can understand student perceptions of learning practices, a link can be established between the actual learning experience and what has been learned.

A gap in the literature exists surrounding higher education preservice teachers' perspectives of their learning while studying child development, learning theories, and assessment strategies, and more specifically, with and without a project-based learning context.

Purpose

The main purpose of this study is to investigate the effect project-based learning has on beginning preservice teachers' academic achievement scores in a course focusing on child development, learning theories, and assessment strategies. A secondary purpose is to explore the effect cognitive styles has on beginning preservice teachers' academic achievement with and without a project-based learning context. Finally, participant's perceptions of instructional styles is examined.

Hypotheses

Two statistical hypotheses have been formed to determine if treatments of project-based learning and field dependency had a significant effect on participant academic achievement scores. The first null and alternative hypotheses including project-based learning and academic achievement are:

- $H1_0$: Participants who engaged in project-based learning will have the same mean academic achievement test score than participants who received lecture instructional style.

- $H1_1$: Participants who engaged in project-based learning will have a significantly higher mean academic achievement test score than participants who received lecture instructional style.

The second set of hypotheses for field dependency and academic achievement with and without a project-based learning context are:

- $H2_0$: There is no correlation between a participant's field dependency and his or her academic achievement test score after engaging in project-based learning instructional style.
- $H2_1$: There is a significant correlation between a participant's field dependency and his or her academic achievement test score after engaging in a project-based learning instructional style.

Significance

This study is designed to be of theoretical importance in that it addresses a project-based learning context within the undergraduate curriculum in higher education. A significant finding is an increase in academic achievement while engaging in a project-based learning instructional style would add support to the theory of active learning and the overall philosophy regarding constructivism.

Similarly, new knowledge of field dependency in relation to project-based learning and academic achievement could add to the body of existing literature regarding characteristics of each type of learner. A significant result concludes a relationship with project-based learning in the classroom.

This study is designed to be of practical significance by providing higher educators with strategies for teaching in higher education classrooms. Project-based learning instruction

provides students with real life learning opportunities. A significant result shows higher academic achievement scores due to collaborative instruction and gives preservice teachers a methodology they could use in their future classroom.

By also exploring field dependency cognitive style, students can become aware of their own style and how they work in a lecture instructional style and a project-based learning instructional style. This concept is important for instructors in that, teachers need to become sensitive to their learning needs and the needs of others (Rosenfeld & Rosenfeld, 2008)

Due to the minimal amount of literature combining the effects of project-based learning and field dependency with academic achievement, there is a need to fill this gap in the literature. As research develops in these areas, education and higher education programs can become more knowledgeable in teaching its students while considering individual learning differences. This will benefit the students, but also set a good example for preservice teachers.

Definitions

Preservice Teachers

Preservice teachers are those enrolled in a teacher preparation program. This proposed study focuses on beginning preservice teachers in the second education course in the program's series. These preservice teachers range could be any type of major within the college of education; elementary, secondary, physical education, agricultural education, early childhood development, technology education, theater, and music education. While this study focuses on higher education instruction, the study takes place within a coursed designed for preservice teachers.

Project-Based Learning

Project-based learning (PBL) is a constructivist model empowering students to construct their own knowledge from completing projects, negotiating the curriculum, working cooperatively with other students, to increase problem solving and critical thinking skills. Markham, Larmer, and Ravitz (2003) define project-based learning as "a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks" (p. 4).

Cognitive Style

Essentially referring to how people think, the theory of cognitive style Witkin, Oltman, Raskin, and Karp (1971) define cognitive style as "the characteristic, self-consistent patterns of organizing and processing information or the modes functioning which individuals show in their perceptual and intellectual activities" (p. 3).

Field Independence/Dependence

Field independence/dependence refers to the cognitive style of "to which the organization of the prevailing field dominates perception of any of its parts" (Witkin, Oltman, Raskin, &Karp, 1971, p. 7). This describes an individual ability to separate information from its context. Field dependent individuals rely on the contextual information to perceive and complete a task, while field independents rely on internal analytics to take something out of context and complete it. Throughout the following chapters, this concept is referred to as field dependency, unless otherwise specified.

Assumptions

An underlying assumption within this study is that a learning, development, and assessment course will remain as an important part of a teacher preparation program and that project-based learning will continue to be a successful implementation of active learning constructivist pedagogy.

Several limitations are anticipated within this proposed study. Students are self-selecting themselves into each section of the course such motivations could affect the outcomes of the project. While the course section's enrollment will differ greatly, so may the students choosing to participate. Participant test-taking ability on a multiple choice assessment is a limitation for how well academic achievement is assessed. A possibility of contamination of groups may occur as the control and experimental groups will have access to each other during the course of the semester. A Hawthorne effect is evident as students will know whether they are in the experimental or control group due to the class activities which indicates they may perform differently because they know they are being studied. Other threats to validity are maturation of knowledge, historical, and testing which are further discussed in the validity section.

A main limitation of this study is that it is limited to the students enrolled in the face-to-face courses on the main campus. Thus, study findings may not be a representative of other teacher education students, project-based learning techniques, and their cognitive styles throughout the United States or external to United States. The instructor's knowledge and assistance may also be a factor in the outcome of the study. A more extensive explanation of limitations and threats to validity is described in Chapter 5.

Summary

This study examines the effect of PBL instructional style and field dependency on academic achievement in higher education. Chapter 1 discussed the practical and theoretical significance of this study. While presenting the problem of collegiate classrooms using lecture and not adapting to today's learners, Chapter 1 also provided a potential solution of using collaborative PBL instructional style to improve academic achievement. In the next chapter, a more in-depth presentation of literature on project-based learning and field dependency is discussed.

Chapter 2: Review of the Literature

Project-Based Learning

"Learning should be meaningful and relevant to the students because they will be eager to find out more about what they are learning and therefore can draw from these experiences" (Dewey, 1916, p. 32). Drawing from Dewey's learning theory, project-based learning (PBL) researchers have shaped the world of PBL. Markham, Larner, and Ravitz (2003) define project-based learning as "a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks" (p. 7). Because Dewey believed students need to be involved in a meaningful and relevant experience, PBL provides a framework for students to explore through inquiry. This process allows students to solve problems and create a deeper understanding (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Moursund, 2001; Perkins, 1992). Caine, Caine, and McClintic (2002) suggest each person has an innate drive to explore, understand, and make meaning of the world around them. Fleming (2000) proposes it is this drive that PBL directly connects to the Constructivist perspective. Thomas (2000) describes five characteristics of PBL:

- Centrality: a project that is central to the curriculum
- Driving question: the project should focus on a question or problem that have a purpose
- Constructive investigation: activities involves a construction of knowledge
- Autonomy: projects and curriculum are student driven
- Realism: projects are authentic to real-world application

According to Vygotsky (1962) and others of the time, PBL fosters direct construction of knowledge through self-directed projects. This real-world authentic learning situation is crucial for student learning rather than the previously thought direct instruction from teachers (Boud, Cohen, & Walker, 1993). Vygotskian perspective of the Zone of Proximal Development yields itself to the PBL format where students are able to create a pathway of inquiry and discovery from their current knowledge to a goal of what they need to learn. Through inquiry and discovery, students are able to construct their own knowledge or truth and allows students to learn from a variety of perspectives.

Many of the influences pertaining to success and working with other collaboratively with classmates, includes confidence, motivation, and the choice of making decisions. Bandura's (1977, 1993) research on motivation and self-efficacy largely influences the effect of a PBL classroom. Self-efficacy, described as the belief in one's self of how effective their actions are, directly affects the confidence and motivation in repeating similar tasks and working with others. The motivation of the students can play a major role in the outcome of the project, but also the learning that has occurred. Motivation can also be effected by the self-efficacy of the students involved which may also have an effect on the outcome of the projects. The learning successes are intrinsically linked to the ability to self-regulate learning and behavior. These constructs affect how a student performs within a project-based learning environment and the self-efficacy and motivation have shown to increase as a result of providing the opportunities in project-based learning (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991).

Some argue that freedom of choice is important to a student's learning. Glasser's (1988) Choice Theory meets the needs of a person's requirement for choice and self-

expression. By using a PBL pedagogy, students are required and able to make decisions that affect the outcome of a project and their learning. The choices a teacher can offer in a PBL environment can range from allowing students to choose groups, choose topics, creation of a grading rubric, a choice in how to present the material learned, and a choice in the social negotiation of curriculum. With a connection to motivation, it is an individual need to learn and make choices which fulfills a need and increases motivation (Prensky, 2001).

While PBL is deeply embedded in theoretical constructs including Constructivism, motivation, and choice theory, there is evidence of PBL being a positive influence on student learning as an effective pedagogy.

Process of Project-Based Learning

In PBL's pedagogy, the teacher becomes the facilitator rather than the sole source of information. As a more representative idea of life and learning after high school, students can benefit more from a teacher who assumes the role of a facilitator (Harada, Kirio, & Yamamoto, 2008; Boss & Krauss, 2007; Newell, 2003; Blumenfeld et al., 1991).

From a teacher's perspective, PBL curriculum can be viewed as a unit of study that lasts over a significant period of time from a few weeks to the whole school year. Characteristics of this curriculum as described by Moursund include:

The teacher's perspective

- Authentic content and purpose, with a major emphasis on higher-order thinking and problem solving
- Uses authentic assessment
- Is teacher facilitated (but the teacher is much more a 'guide on the side' than a 'sage on the stage'

- Has explicit educational goals
- Is rooted in constructivism
- Is designed to facilitate transfer of learning
- Is designed so that the teacher will be a learner

While from the student's perspective:

- Is learner centered and intrinsically motivating
- Encourages collaboration and cooperative learning
- Allows students to make incremental and continual improvement in their products, presentations, or performances
- Is designed so that students are actively engaged in doing things rather than in learning about something
- Requires students to produce a product, presentation, or performance
- Is challenging, with a focus on higher-order skills (2003, pp. 12-14)

The project represents the learning that occurred throughout the process and can be any form that the students choose. With an overall educational outcome, students are expected to not only learn about, but to produce a project showing they met a standard or answered a question.

Curriculum and material in classes are socially negotiated with a shared responsibility. This means, the teacher and the students work together to discuss the needs throughout the project. If the students need clarification of a topic, that is agreed upon with others and the teacher, then that is what is done in class. If students may want to choose to take advantage of the time in class to work with other groups reading or discussing material. Each day and each

group of students can differ in terms of what is being discussed and completed during class time.

The use of technology is an important concept for PBL. Vygotsky believed cultural tools were important for a person to construct their own knowledge. With the increase in personal technology in recent years most people have access to technology whether it be person, family, the school, or the public library. Most of the technology in use also has Wi-Fi or other internet connections including smart phones, computers, tablets, and laptops. As a cultural tool, many teachers are incorporating this technology into their classroom as a resource in order to embrace societal change. Within the PBL framework, students can use technology to not only get information, but also to share the information they have found. This sharing of information can take place within many computer programs and be part of the overall project and presentation.

Effective Pedagogy

Allowing students to connect real life experiences outside the classroom to learning that occurs inside the classroom, PBL is an effective practice and learning strategy to make this connection within today's standard-based curriculum, "To educate is to expose kids to many possibilities until they find a connection between what's really important to them and the world out there. And then we must nurture and cultivate that connection (Csikszentmihalyi, 2002, p. 17). Reflecting Dewey's "learning by doing" concept, the project-based pedagogy has shown success when students' projects are perceived as relevant to them and their lives (Kozminsky & Kozminsky, 2003; Cutris, 2002; Caine, Caine, & McClintic, 2002; Fleming, 2000; Zimmerman, Bandura, & Martinez-Pons, 1992).

With the teacher as the facilitator, it is important to manage or oversee the process and products of the group. Because the students work collectively and collaboratively, students are able to learn how to effectively work as a group. Their participation fosters self-efficacy, leadership skills, and motivation to produce good products while learning necessary information. This mimics life after high school as well. While in the workforce, groups of employees must work together to produce a product or to achieve a common goal while a manager or facilitator oversees progress. This cooperative learning skill is beneficial for all students to learn at an early age as they progress through life (Glasser, 1990). Through this motivation, needs are met and students become more interested in their schoolwork and learning outside of school.

While there are many benefits of a PBL format, among the most important according to Blumenfeld and others (1991), is the real world experience and 21st Century skills, along with critical thinking and metacognitive development. Empowering students to become independent problem solvers, individuals are able to become more self-regulatory in their learning and are able to apply their knowledge to new information while resolving a problem or achieving a goal (Barron & Darling-Hammond, 2008; Thomas, 2000; Katz & Chard, 1989). It is important to teach students how to work collaboratively (Johnson & Johnson, 1999; Wiburg & Carter, 1994) and guide them through the process of project-based learning which can be taught at an early age by adding pieces to the curriculum (Katz & Chard, 1989). When metacognition has fully developed by middle school, students can be taught to actively participate, set goals, and monitor and assess their own learning (Rafoth, 1999). Moursund describes opportunities benefiting students including:

- To learn how to design, carry out, and evaluate a project that requires sustained effort over a significant period of time
- To gain more interactive technology (IT) knowledge and skills
- To learn to work with minimal external guidance
- To gain in self-reliance and personal accountability. (2003, p. xi)

In comparing PBL to a more traditional format, PBL has benefits not only in skills that students learn, but in academic achievement, 21st Century skills, equity, and motivation. Within a PBL format, students have a deeper understanding of content and retain it longer (Bell, 2010; Penuel & Means, 2000; Stepien, Gallagher & Workman, 1993). In disciplines including math, economics, language, and science, PBL has been more effective than more traditional methods (Beckett & Miller, 2006; Boaler, 2002; Geier et al., 2008; Mergendoller, Maxwell, & Bellisimo, 2006). Frank and Barzilai (2004) note that students in a PBL format perform as well as or better on high-stakes tests than students in a more traditional method.

With a large focus in education, 21st Century skills are said skills to prepare students for life after high school, through college and into their careers. These skills include:

- Digital age literacy
- Inventive thinking
- Effective communication
- High productivity
- Incorporate core subjects
- Global awareness
- Technology skills
- Life skills

Finkelstein et al, (2010) share their research on problem solving skills and PBL. They found students from PBL contexts have better problem solving skills and show more success when applying what they learned and know to other real life situations. Similarly, critical thinking skills are also improved with project-based learning pedagogy (Beckett & Miller, 2006; Horan, Lavaroni, & Beldon, 1996; Mergendoller, Maxwell, & Bellisimo, 2006; Tretten & Zachariou, 1995). From a teacher's perspective, Hixson, Ravitz, and Whisman (2012) discuss implications of PBL lending itself to more time in the classroom to work on 21st Century skills rather than focuses on the content specifically.

Project-based learning can be beneficial for other types of reasons, such as equity. In order to perform a school reform, PBL can serve as a source of pedagogy for all teachers to adopt in their classrooms which will serve students well throughout the years in attendance (Cross, 2004; Newmann & Wehlage, 1996; Ravitz, 2010). Hixson, Ravitz, and Whisman (2012) discuss the benefits for diverse learners including different types of schools, cultures, and populations. This is very important with the amount of diversity within each and every classroom. PBL lends itself well to culturally responsive teaching and curriculum. Among diversity, PBL has shown benefits for lower achieving students as well in closing the achievement gap (Hixson, Ravitz, & Whisman, 2012; Doppelt, 2003).

Project and problem based learning. Not to be confused with Problem-Based learning, Project-Based learning focuses on creating a project as a result of responding to a question and producing a product. Although the two strategies share similar attributes, problem-based learning is the act of solving a problem through inquiry solely, rather than producing a project (Kain, 2003). As an enhancement to direct instruction and other

traditional teaching practices, problem-based teaching uses students' previous knowledge with new knowledge to solve a problem and/or reach a conclusion.

Although much of the process is similar, the product is very different within the paradigms of problem or project-based learning. Problem-Based learning is used in many areas in K-12 schools, medical schools, architectural, and economic programs (Moursund, 2003). With problem-based learning being a more widely researched area, it can be seen as a type of active learning strategy in the classroom. Active learning is the philosophy supporting the use of students being involved in their learning. Active learning strategies can be described as "instructional activities involving students in doing things and thinking about what they are doing" (Bonwell & Eison, 1991). When students think about their thinking, it is described as metacognition, which can also have implications for an active learner. In making learning as authentic as it can be, students develop critical thinking and problem solving skills through active learning activities (Sivan, Leung, Woon, & Kember, 2000). This idea will not only aid them in the learning of current material, but provide skills for learning in future classes. Students not only will learn more, but they find more motivation and enjoyment in those courses that prompt them to be active (Lawson, 1995; Watson, Kessler., Kallas, Kam, & Ueki, 1996). Problem-based learning and project-based learning are direct subsets of active learning strategies.

With the lack of experiential learning processes where students specifically learn from their own experiences (Kolb, 1984), using an active learning strategy of problem-based learning with case studies can help students connect theory to a real-life situation. Historically, problem-based learning originated when medical students jumped to conclusions without considering alternatives and the researchers noticed that working through a problem

was more effective to these students rather than only memorization (Barrows & Tanblyn, 1980). Original literature on problem-based learning focused on four main ideas: to develop reasoning skills, based in appropriate contexts, to help students become more aware of real-world skills, and to create autonomous learners (Coles, 1985).

Principles within problem-based learning comprised by Boud (1985) include: an understanding of students' current experiences, students taking the role and responsibility of their own learning, problem-based learning may be an integration of many subjects, it requires the interactions of both theory and practice, a focus on the process of learning rather than the product, changes in the teacher as more of a facilitator and considers alternative assessment strategies, and a strengthening of interpersonal skills. While these were the original focus points of problem-based learning, many researchers on the process of problem-based learning currently and generally agree on many of the following characteristics. Firstly, the beginning point of the process of learning begins with a problem what is based on a real-life situation that may or not be hypothetical, but preferably be a situation that actually happened. The process should be self-directed in which the learners are directing the procedure or conversation as they see fit. The learners should also be able to expand the ideas to their own experiences and ideas, participate in a group-based discussions and activities, and practice the concepts in order to transfer their knowledge (Kolmos, 1999; Vleuten, Norman, & de Graaff, 1991). Project-based learning, used these ideals and expands it to create a project.

Project-Based Learning in Higher Education

Shown as a benefit to students learning within the classroom, how does project-based learning work in higher education? Barak and Dori (2005) explored a PBL format within an introductory chemistry class at the collegiate level, and found students who completed

projects as part of the course had higher academic achievement on a final exam than students in a control group. Similar research and findings on PBL has also been completed with other undergraduates (Garrison, 1999; Helle, Tynjala, & Olkinuora, 2006; Smith, 1998; Barak & Raz, 2000; Gulbahar & Tinmaz, 2006; Marx, Blumenfeld, Krajcik, & Soloway 1997; Tinker, 1996). Smith (1998) found that test scores in a statistics course greatly improved after using a project-based format. Particularly in statistics courses, Hogg (1991) suggests that using previously researched data as part of course assignments, while still valid, it would be better for students to actually generate their own data to use.

More specifically, within preservice teacher education some research has used a project-based learning format with science and technology or other subjects through a means of using computer-based technology. Franklin and Molebash (2007) tracked elementary preservice teachers for five years with their use of technology as they began teaching. These preservice teachers were enrolled in a social studies methods course that used technology in a project-based format. Those teachers, even with the constraints of the first years of teaching were able to translate their knowledge of technology from the PBL to other areas in their classroom, not just the social studies topics.

Science, math and technology methods courses utilized project-based learning with preservice teachers resulting in higher transfer, appreciation of real-life experiences, increased motivation, and ability to use project-based learning in their future classrooms (Pea, Edelson, & Gomez, 1994; Christiansen & Knezek, 2000; Reis & Karadag, 2009; Frank & Barzilai, 2004; Piccinini & Scollo, 2006). Similarly, but less often, PBL has been used throughout literacy methods courses as well (Masats & Dooly, 2011; Mokhtar, Majid, & Foo, 2008; Vinogradov & Liden, 2008).

Giving preservice teachers the opportunity to learn in a project-based learning format gives them the opportunity to become familiar with the process in order to use it in their future classrooms. As Masats and Dooly (2011) describe the success of PBL with preservice teachers:

> Gave the student-teachers a bird's eye view on project-based learning, thus promoting teacher development beyond the mere theoretical of the imminently practical….surveys showed that the students were generally satisfied with the materials used; three of the respondents wrote that they had learnt by carrying out project-based learning as both a student and a teacher. (p. 1159)

Though the benefits of project-based learning remain strong as whole, but it may not be optimal for everyone. As Kirschner, Sweller, and Clark (2006) suggest, "based on our current knowledge of human cognitive architecture, minimally guided instruction is likely to be ineffective" (p. 76). With the argument opposing an unstructured environment, others discuss the benefits for different types of learners or different intelligences. Mokhtar, Majid, & Foo, (2008) contest that the student-centered environment using multiple intelligences in an information literacy training created lasting retention and is a benefit for students.

The way people think and use resources could have an effect on how productive PBL environments and the outcome of projects. Cognitive styles, or the way people think, are telling of a learner's needs in the classroom. A student who enjoys working and discussing concepts with others may find it easy to participate in a PBL classroom, while those who would rather work on their own, might struggle within a more unstructured cooperative environment.

An example of a cognitive style is the concept of field dependency; an individual who uses external and contextual information to process information is categorized as field dependent and those who rely on internal problem solving skills are more field independent. There are a few researchers who have connected the ideas of field dependency and project based learning. Field dependency theory guided research with project-based learning in an adaptive web-based class. Magoulas, Papanikolaou, and Grigoriadou (2003) explain that developers of this web-based learning course, have tried to adjust to their students, "several web-based systems have taken into account individual differences to adapt the content, the presentation, and the problem solving and navigation support" (p. 513). By identifying a relationship between field dependency and the web-based guided learning, the instructors of the course describe the adaptation to field dependency as being "beneficial to field dependent students who usually experience problems when they are offered several options" (p. 517).

In an architectural program with a project-based learning curriculum, Roberts (2005) explains how students in his study were separated into three groups according to their cognitive style as measured by the Cognitive Styles Analysis (Riding, 1991). The Cognitive Styles Analysis uses verbal and visual responses to stimuli in which Roberts identified participants as wholist, intermediate, or analytic. Riding and Cheema (1991) describe wholists as people who organize information as a whole and analytics break information down into smaller parts. Roberts tracked students for three years throughout their architectural program. For the two cohorts studied, during the first two years of the program the analytic students were ranked higher than their intermediate and wholistc peers, however during the third year, all groups were probably the same. Architecture lends itself to be a

hands-on area of study and to a project-based learning context in which Roberts describes as the curriculum for the program (2005).

Regarding the unstructured organization of PBL, research on cognitive styles in students-centered environments show field dependent learners improving in structured environments and field-dependent learners are most effective in a linear or hierarchical structure (Hannafin, Hannafin, & Gabbitas, 2009; Graff; 2006). Not only are student's abilities to think as a whole or in pieces within a PBL classroom effected by their cognitive style, so is the amount of structure given by the teacher.

Extending to teachers, a case study explored three teachers with extreme beliefs of their learning styles. Importantly, as a teacher, these teachers teach the way they prefer to learn, overgeneralize and project their needs onto students, and tend to blame the learner for learning styles not similar to them. These differences can affect different classroom practices including project-based learning (Rosenfeld & Rosenfeld, 2008). While this study was completed with inservice teachers, there is little research utilizing preservice teachers, project-based learning, and cognitive styles.

Field Dependency

Cognitive styles, including field dependence and independence, pervades the literature as part of the many changes in educational reformation in the past (Burton, Moore, & Holmes, 1995). As with learning styles, teachers understand the importance of reaching each student based on how they learn. Much of the research surrounding field dependency was associated with computer-based instruction in the 1990s. In that time, society saw an increase in technological advancements and use in everyday life, not only personally, but in also in public places and schools. Researchers explored the role of cognitive styles with technological

advances (Wooldbridge & Haimes-Bartolf, 2006; Sadler-Smith, 1996; Weller, Repman, Lan, & Rooze, 1996; Chinien & Boutin, 1993). It was noted, cognitive styles could lead to adaptations in curriculum and instruction and differentiated instruction for a variety of students' thinking and learning styles (Witkin & Goodenough, 1981).

Cognitive styles can be defined as differences in the way people think. Not only do cognitive styles influence all aspects of a person's life, including, "cognition, social, and interpersonal functioning," but they also, "represent consistencies in the manner or form of cognition" (Messick, 1976, p. 5). Cognitive processes are said to be a fixed characteristic that is developmental and continuous (Riding & Cheema, 1991). As a characteristic that stays the same throughout one's life, cognitive processes develop with the child and remain as a constant increase until the individual fully develops cognitively.

Differences in learning style and cognitive style. In discussing an individual difference in preferred ways of processing information, cognitive styles differ from learning styles in that Kolb (1984) describes style as an individual strength that form the foundation of a preferred learning style as a whole. As a more general thinking style, cognitive styles are characteristics of processing particular to an individual, whereas a learning style is the way a learner perceives, interacts with, and responds to the learning environment. Learning styles are affected much more by other domains than just cognitive including affective, psychological, culture, and personality.

Types of cognitive style. As an independent construct, cognitive style has many facets. These types of cognitive style include: one-dimensional models such as field dependent/independent, convergent and divergent thinkers and left brain/right brain/whole brain (Carey, 1991; Allinson-Hayes, 1996). Multi-dimensional models can be measured by

the popular Myers-Briggs Type Indicator or the Cognitive Style Analysis in which individuals are wholistic-analytical or verbal-imagery (Riding & Cheema, 1991). A third cognitive style aspect is the Adaption-innovation theory where an individual's problem solving approach can be found on a continuum between adaptation and innovation (Kirton, 1976, 2003).

Looking specifically at field dependency and independency, Witkin (1978) explains the field dependency construct as "the tendency to rely primarily on internal referents in a self-consistent way we designate a field-independent cognitive style. The tendency to give greater credit to external referents is a field-dependent cognitive style" (p.16). Further research define field dependency as the ability to separate contextual information (Witkin & Goodenough, 1981) and "the degree to which a learner's perception or comprehension of information is affected by the surrounding perceptual or contextual field" (Jonassen & Grabowski, 1993, p. 87). While field dependency idea is a cognitive psychological structure, researchers describe bodily and visual cues are an important part of separating contextual information (Witkin, Moore, Goodenough, Cox, 1977; Messick, 1976).

While discussion has occurred of categorical implications of field independent and dependent, there are many individuals who may not fit into one particular category. Liu and Reed (1994) describe field independent and field dependent as a continuum and people that fall in between are usually referred to as "field mixed" or "field neutral." This indicates that individuals may experience some difficulty with tasks or activities designed for the extreme ends of the continuum.

Historical development of field dependency. Throughout the years, numerous forms of testing field dependency have been developed. Since the 1940s, the concept itself has been investigated and revised by Witkin and his associates. It was Witkin's belief that the ideas of

field dependency was ever changing, thus needing continuous study and exploration. At the time, field dependency was one of the most widely researched areas of psychology (Asch & Witkin, 1948a, 1948b; Witkin & Asch, 1948a, 1948b). Due to the importance in researching this construct in the mid-1900s, field dependency could benefit current research exploring tasks requiring cognitive skills.

The foundation of the field dependency construct was the focus of research in psychology at the time and many understood it as a matter of understanding perception. Because perception is a factor in the study of cognition, much of the influences surrounding exploration in the of field dependency, began with Gestalt Psychology (Messick, 1986). Gestalt psychology examines perception as a result of various interactions of stimuli (Carlson & Heth, 2010). Witkin began using perception as a basis for understanding cognitive styles and field dependency.

Originally, Witkin investigated how important visual cues were for determining the perceived vertical direction of space, or perception of upright. As mentioned, researchers described bodily and visual cues as an important part of separating contextual information so Witkin began there. Bodily cues in an individual are internal feelings of vertical or gravitational pulls. Processes of this internal cue can important for contextual separation. Assessing whether participants rely on contextual cues or bodily cues, creation of situations that required a decision between visual and gravitational cues was the next step (Goodenough, 1976). Several tests of 'tilted visual fields' include the Rod-and-Frame test, tilting-room test, the rotating room test, and the embedded-figures test, among others, were used to find differences among individual, and their personalities. Through developing these tests, it was found that field dependency correlated with other constructs including problem solving skills,

intellectual ability, and personality which sometimes could be noticed simply by conversing with another person.

As shown in Figure 2.1, Witkin created a pyramidal structure "to account for the personality correlates of field dependence" (Goodenough, 1986, p. 8-9) which we now refer to as the Differentiation Construct. At the top, self-nonself differentiation is the general and broad construct moving downwards to the very specific perception of upright. It was thought that "the more general constructs in the pyramidal structure [toward the top] generated hypotheses about other correlates of field dependence dimension" (p. 8).

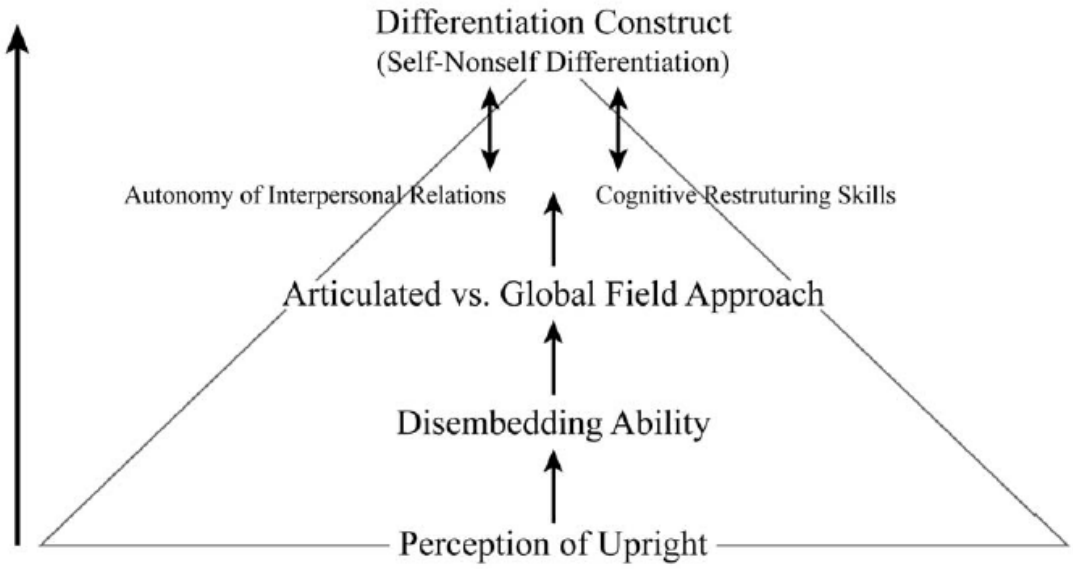

Figure 2.1. The pyramidal structure of the differentiation construct (Cao, 2006).

Psychological differentiation. At the apex of the pyramid, psychological differentiation resides as the broadest idea of the construct. The idea of self-nonself differentiation became important in the perception of upright. Borrowing the ideas from immunology, just as tissues distinguishing between the bodies tissues and non-bodily tissues such as viruses or other foreign antigens, each person distinguishes between the self and the

nonself of environmental contexts. In this theoretical framework and among individual differences, research revealed a differentiation in reliance on external referents and autonomy (Davis & Cochran, 1990). This separation is significant to differentiating in many contexts, not just perception of upright, but with many aspects of cognition. When processing information, individuals rely on either external or internal referents which effects the development of interpersonal and impersonal positioning and their cognitive restructuring ability. As the two sub-categories of self-nonself differentiation, autonomy of interpersonal relations and cognitive restructuring skills explore the immediate application of differentiation.

The autonomy of interpersonal relations is the ability to freely communicate with other people. This construct can vary from person to person much like a continuum and effect other parts of their lives including their ability to differentiate between self-nonself structures. Cognitive restructuring skills include the ability to restructure information within a context individually to use it or apply the information to a new situation. This construct is similar to problem solving skills and is important to problem solving and critically thinking (Jonassen & Grabowski, 1993). Some need to follow an example or have clear instructions for use of the information or on other people for information, while others are more autonomous and do not use external information. This construct is not a matter of high or low skills, but rather where the information used is coming from (internal/external). This broad and general category fosters the more specific aspects of the differentiation construct including articulated versus global field approach, disembedding ability, and perception of upright.

As Riding and Cheema (1991, p. 198) state, cognitive restructuring refers to:

- providing structure for an ambiguous stimulus complex

- breaking up an organized field into its basic elements
- providing a different organization to a filed than that which is suggested by the inherent structure of the stimulus complex

Being able to mentally restructure information and use that information in another context is the basis of this psychological differentiation construct. Research concluded similarities and differences between participants in cognitive restructuring ability when performing a task with different types of information. When participants were given unambiguous information in a structured context there were no differences between field dependents and field independents were found. When ambiguous information was given in an unstructured context, the field independent and dependent learners performed differently. Conclusively, field dependent learners performed similar to the field independent learners when the information was unambiguous (well organized) and in a structured context (Witkin, 1978). This suggests field independent learners are able to restructure information regardless of the context. Connecting to classrooms, cognitive restructuring could have implications for teaching methodologies when teachers provide well organize information and/or well organized contexts.

Articulated versus global field approach. Representing a person's capability to overcome an embedded context is the emphasis of this dimension. At this level, the psychological differentiation is narrowed from the concept of differentiation to focus on an individual's ability to analyze a complex situation within the concepts of perception, intellectual functioning, and structuring ability. Articulation differs from global in that articulated field approach infers an individual separating stimuli from a context and using only the relevant information, while an individual who embraces the whole context is

considered to be using a global approach. For example, a field dependence global cognitive style in an individual indicates a pattern recognition that is strongly directed by the organization of the field. By contrast, a field independent articulated ability relies mainly on the object itself rather than the organization of the context making them more analytical and structuring.

Part of this dimension describes the ability to impose a structure on an unstructured field. For example, a field independent individual would have little difficulty perceiving and separating relevant visual information while problem solving and using that information in a different context, while a field dependent would struggle with the transfer of knowledge from one context to another. Because this dimension contains perceptual and intellectual activities, this finding suggests that individuals perform the same level of articulated ability across multiple types of intellectual activities. Goodenough (1976) expresses "individual differences in expressions of articulated functioning in one area are related to expressions in other areas" (p. 676).

Disembedding ability. Moving to a more specific dimension than the field approach, the disembedding ability dimension focuses on the ability to disembed a simple figure within a complex figure. For example, an individual might be asked to locate a triangle within a picture that has many triangles, squares, and circles. Witkin (1950) developed the Embedded-Figure Test (EFT) to explore the relations to locating geometric shapes in embedded figures. The participants are asked to locate, dissembed, or separate items from a surrounding field in which differs from correcting their bodily physical upright, but requires similar processes (Witkin, Moore, Goodenough, Cox, 1977).

Research identified individuals with issues locating an embedded figure within a more complex context. Those, who are referred to as field dependents, had difficulty locating figures. On the contrary, some participants found it a simple task to identify geometric shapes that have been embedded in a more complex figure. These tasks are highly correlated with other tasks of the psychological differentiation domains and assess the ability to use cognitive restructuring skills (Witkin et al., 1977).

The Embedded Figures Test (EFT) offered potential for assessing orientation without having to use large equipment while still exploring similar cognitive skills. The EFT (Witkin, 1950) involved the participant finding a simple geometric shape such as a triangle in a more complicated, patterned design. This required skills of separating the organized pattern to locate the simple figure. As Witking and Goodenough (1981) stated:

> It was found that subjects who had difficulty separating the sought-after simple figure from the complex design were the ones who could not easily keep body or rod separate from room or frame in the orientation tests – in other words, were the ones who were field dependent. Conversely, people who were field independent in the orientation tests found it easy to overcome the influence of the organized complex design in locating the simple figure within it. (p. 15)

Based on the 1926 work of Gottschaldt's hidden figure test, and the parent test (EFT), the Group Embedded Figures Test (GEFT) was created. After being developed, the GEFT remains to be the most common test for field dependency (Oltman, Raskin, & Witkin, 1971). The GEFT is compiled into a booklet with 25 figures that can be completed in 10 minutes. Administration of the GEFT to a group of participants allows for multiplicity of data while the scoring remains simple by totaling how many correct responses are made within the allotted

time periods. In the light of 21st century technology, Mind Garden, Inc. and researcher Jack Demick have developed an online version of the GEFT. While the pencil and paper GEFT has received many studies of reliability and validity (Demick, 2014; Pithers, 2002; Thompson & Melancon, 1987), the developers of the online GEFT are currently conducting validity and reliability studies (Demick, 2014).

Perception of upright. Witkin began his investigations by exploring differences in peoples' perceptions of upright space. As the most specific dimension of the Differentiation Construct, this smallest form of individual difference in which participants align something to true vertical in space or they align something to vertical according to context. This is evident from the original Rod-and-Frame test in which the participant was asked to align a rod which was inside of an illuminated frame to the upright position. The Rod-and-Frame Test (RFT) was created to assess whether participants would use contextual clues or bodily cues to align a rod with upright; perceptual upright. Participants were asked to sit in a completely dark room with an illuminated square frame had a luminous rod pivoted in the center of the square. The frame and the rod were tilted at an angle independently to the left or the right in which participants were asked to adjust the rod to the upright position according to their perception. Individual differences were found in how participants adjusted the rod; some adjusted the rod upright to the frame, even if it was tilted and others adjusted it regardless of the frames position as a separate entity and upright to gravity's vertical. Participants who adjusted the rod to the upright of the frame are more contextual and classified as field dependent, while those viewing the objects as independent entities are referred to as field independent.

Witkin noticed differences between whether participants aligned the rod with the frame's upright vertical or with the gravitational vertical. It is in the direction of apparent

vertical which is concluded from information including the field, environment, or context, this is most often the visual surroundings. Also part of that information is the direction of gravity itself. This is perceived through bodily sensations of up and down. It is through these two sets of information including visual referents and bodily sensations were influencing the position of upright in which the individual differences occur (Witkin & Goodenough, 1981; Witkin , Moore, Goodenough, Cox, 1977).

Because this measurement takes place in a dark room with permanent and large equipment, researchers needed a more accessible version to test more participants and in more places. For the ease of testing this concept, a portable version was created and also tested for appropriate reliability and validity (Oltman, 1968). Other researches created a more 'home-made' version which was also successful in collecting data with full reliability and validity (Nickel, 1971).

Body adjustment test. In another measurement for perception of upright, the Body Adjustment Test, participants were in a tilted room in which they were to adjust the chair (which may or may not be tilted independently) to the correct upright. The (BAT) was developed to assess how participants use visual and bodily cues in the perception of upright. In this assessment, participants were asked to sit in a chair in the middle of a small tilted room. This room could be moved clockwise or counterclockwise, while the chair could be independently also moved clockwise or counterclockwise. Participants were asked then to adjust the chair from the initial position to the perceived upright position. "Subjects were using the external visual field as the primary referent for perception of the upright, essentially to the exclusion of sensations from the body" (p. 9) Similar to the Rod-and-Frame test, some participants adjusted the chair to the context of the tilted room while others adjusted to a more

gravitational vertical. “Clearly, some subjects we reusing the external visual field as the primary referent for perception of the upright, essentially to the exclusion of sensations from the body….Most subjects brought their bodies to a position somewhere between these two extremes” (Witkin & Goodenough, 1981, p. 9). Some use more of an internal gravitational pull vertical in which they differed from the room context. Combining the two tests, Rod-and-Frame and another test, the Body Adjustment Test, that are highly correlated, “people who ignored the tilt of the room also ignored the slant of the frame; these people were described as field independents. Field dependents, on the other hand, relied consistently on the surrounding, the room, or the frame, for their orientation” (Cross, 1976, p. 117).

Rotating-room test. Similarly, in the Rotating-Room Test (RRT), participants were asked to sit in a left or right tilted chair in a small upright room. The room was driven on a circular track to rid the gravitational force on the body. Participants were asked again to adjust their body to what they experienced as straight. “When subjects were tested in all of [the tests], they tended to be self-consistent with regard to degree of reliance on external field or body” (Witkin & Goodenough, 1981, p. 13). The participants who adjusted their body to the tilted room in the BAT also aligned their body to the upright room in the RRT and tilted the rod to the frame. On the opposite extreme, those who relied more on bodily or gravitational cues aligned their body and the rod with ‘true’ vertical. Those “who ignored the tilt of the room also ignored the slant of the frame; these people were described as field independents. Field dependents, on the other hand, relied consistently on the surroundings, the room or the frame, for their orientation” (Cross, 1976, p. 117).

Table 2.1 shows the difference between field independent and dependent learners with respect to each of the dimensions of the Differentiation Construct.

Table 2.1. Characteristics of field dependent and independent learners. Adapted from Witkin & Goodenough, 1981; Demick, 2014; Witkin et al., 1977

	Field Independent Learner	Field Dependent Learners
Self-Nonself Differentiation	Relies more on self; more bodily connected	Relies more on nonself, external information
Autonomy and Interpersonal Relations	Greater autonomy from external information; lower interpersonal relations	High interpersonal communications and relations; less autonomous of information from external sources
Cognitive Restructuring Skills	High ability Relies on internal skills; does not use external sources of information	High ability Relies on the external sources for restructuring
Articulated vs Global Field Approach	High articulation (pulling out one or two pieces of relevant information) and high transfer to new contexts	High global (embracing the whole) approach to understanding with low transfer to new contexts.
Disembedding Ability	Able to easily and quickly identify simple figures within more complex figures	Has difficulty identifying simple figures within more complex figures
Perception of Upright	Perceives and aligns 'upright' with gravitational/bodily cues for vertical. Aligns rod and chair with gravitational vertical, independently of context	Perceives and aligns 'upright' within the context. Aligns rod with box, adjusts chair with context of the room
Other Characteristics and Correlates	Active, hypothesis-testing role in learning	Passive, spectator role in learning
	Acquires general principles more easily	Acquires specific information more easily
	Intrinsic or task-oriented motivation	Extrinsic forms of motivation
	Learns better on learner-centered tasks	Learns better with socially relevant information
	Creates organization on an unstructured field	Take organization of field as given
	Uses structures and reorganizes materials for more effective storage and retrieval of information	Uses existing organizational materials in cognitive processing
	Greater accuracy in estimating what distorted images 'should' look like	Greater sensitivity to nuances of social relationships
	Socialization patterns emphasizing autonomy and independence	Socialization patters emphasizing conformity and dependence on authority
	Unrelated to overall academic achievement	Tendency to rely on others for guidance

Characteristics of field dependency. As seen in Table 2.1, deductions about characteristics of field independent and dependent learners have been made from research on psychological differentiation dimensions. Since this theory has been developed, research has focused on other characteristics of individuals in their ability to function as learners in everyday life. While many of these characteristics are correlations, many individuals exhibit characteristics of both styles (Saracho, 1989).

The ways individuals perceive, understand, and respond to information for educators to know when planning curriculum and instruction (Ramirez III & Castaneda, 1974). In regards to problem solving skills, field dependent learners tend to be more passive and do what others may lead them to do while field independent learners take a more active, hypothesis-testing role when problem solving. Field independent individuals tend to pay more attention to details and relevant information while analyzing the task while dependents become distracted, creating difficulty when perceptual functioning or cognitive restricting is necessary (Witkin & Goodenough, 1981; Davis & Cochran, 1990; Jones, 1993). These many characteristics are important to note when designing classroom activities leading to improved learning performance. If a classroom's instruction focuses on self-guided tasks in a problem solving environment, field dependent learners may struggle more than field independent learners. Furthering this idea, Jones (1993) describes difficulties for field dependent learners in less structured environments saying:

> Field dependents are disadvantages in unstructured situation whereas field independents tend to provide their own structure more readily; field dependents prefer directions and feedback, whereas field independents are less dependent on feedback;

field dependents rely more on others for information, whereas field independents are less influenced by peers. (p. 199).

Summary

This section on cognitive styles and field dependence/independence provided a definition, an overview of the history, tests, and characteristics, leading to implications for education. The previous section of the literature review described project-based learning in different environments as well as the suggestions for use in higher education with different learning and cognitive styles. There is little literature describing the quasi-experimental effects of project-based learning on academic achievement with preservice teachers and the effects of cognitive style on project-based learning and academic achievement. The next chapter explains the methodology for this study to explore the effects of project-based learning and cognitive styles within PBL on academic achievement.

Chapter 3: Methodology

The literature review suggested project-based learning has a positive effect on increasing academic achievement at the collegiate level. There is a significant gap in the literature exploring the effects of cognitive styles on academic achievement with and without project-based learning instructional style. Little research has been published utilizing a quasi-experimental switching replications design for project-based learning success. Furthermore, while these concepts are minimally researched, studies regarding preservice teachers within these concepts are fewer.

This study sought to explore the impact of project-based learning (PBL) and field dependency cognitive styles on academic achievement. Due to the nature of this study, it is different from previous research in both areas of PBL and cognitive style. Much literature in PBL's connection with academic achievement focused on K-12 classrooms and while some research worked with collegiate level students, this study focused primarily on preservice teachers and academic achievement within child development, learning theories, and assessment strategies. The body of research on cognitive styles, specifically field dependency, has been researched since the 1950s and correlated with many constructs including personality, intelligence, perception, and academics, but not yet with PBL.

Hypotheses

The project-based learning instructional style is labeled the independent variable and treatment, while academic achievement is the dependent variable. Field dependency remains a construct that is itself an independent variable. These labels are deemed as such to prevent confusion within different constructs in the methodology section.

Two statistical hypotheses were formed to determine if the treatment of PBL instructional style and the construct of field dependency had a significant impact on participant academic achievement scores based on unit assessment tests from the course textbook test bank (Woolfolk, 2013). The first null and alternative hypotheses regarding PBL and academic achievement are:

- $H1_0$: Participants who engaged in project-based learning will have the same mean academic achievement test score than participants who received lecture instructional style.
- $H1_1$: Participants who engaged in project-based learning will have a significantly higher mean academic achievement test score than participants who received lecture instructional style.

The second set of hypotheses for field dependency and participants' academic achievement during PBL instructional style include

- $H2_0$: There is no correlation between a participant's field dependency and his or her academic achievement test score after engaging in project-based learning instructional style.
- $H2_1$: There is a significant correlation between a participant's field dependency and his or her academic achievement test score after engaging in a project-based learning instructional style.

Study Overview

True randomization could not be followed, so a quasi-experimental design was employed. Two sections of a teacher education development, learning, and assessment course were utilized, in which three unit topics were studied: child development, learning theories,

and assessment strategies. These two sections participated as a control group for different instructional units throughout the semester in a switching replications design. A pretest was administered prior to each unit to determine the equity of the two course sections. In the first unit child development, one course section (group 1) received the treatment by engaging in the project-based learning instructional style, while the second course section (group 2) participated in the lecture teaching instructional style. Throughout the second unit addressing learning theories, both course sections received lecture instructional style. In the third unit addressing assessment strategies, the second course section (group 2) participated in the treatment by engaging in project-based learning instructional style and the first course section (group 1) remained in a lecture instructional style. At the end of each unit, academic achievement was assessed and evaluated by using the textbook's test bank (Woolfolk, 2013) referred to as the unit assessment tests.

Research Design

As mentioned, a quasi-experimental design was employed. More specifically, a switching replications, convergent mixed-methods design was used where quantitative and qualitative data sets were collected for a better understanding of the phenomenon (Creswell & Plano-Clark, 2010). Quantitative measures included the Group Embedded Figures Test (GEFT) scores, academic achievement test score, and the project-based learning academic achievement score. Qualitative data included individual participant preferences and perceptions of the instructional styles utilized throughout the course. See Table 3.1 for design.

Table 3.1: Multiple Measure Design.

	Unit 1 Child Development	Unit 2 Learning Theories	Unit 3 Assessment Strategies
Group 1	GEFT, Demographics, Pretest PBL Instructional Style Project Posttest	Pretest Lecture Instructional Style Posttest	Pretest Lecture Instructional Style Posttest Reflection
Group 2	GEFT, Demographics, Pretest Lecture Instructional Style Posttest	Pretest Lecture Instructional Style Posttest	Pretest PBL Instructional Style Project Posttest Reflection

Participants

All participants were treated in accordance with the ethical guidelines of the American Psychological Association (APA, 2010) and the study was certified by the university's Institutional Review Board (see appendix A). All data, including possible identifiers, were kept confidential throughout and will be kept for three calendar years. Names and other possible identifiers are not linked to data presented in the written analysis, however for individual comparison purposes, the researcher was able to link data with a participant. Participants and their data were numbered in order to certify confidentiality. Every caution was taken to ensure all participants remained comfortable and that they knew they could withdraw their permission from the project at any time without penalty (see appendix B for informed consent).

A sample of students taking the development, learning, and assessment course, were invited to participate in this study. Participants completed a demographic information page including age, gender, ethnicity, level in school, and major (see appendix C). With two sections of the course, 80% were female, 86% were between the ages of 18 and 21, 88%

identified as Caucasian, 60% were sophomores, and 48% were majoring in elementary education, 43% were secondary education, and 8% were not education majors. See Table 3.2 for demographic details. At the beginning of the study, there was a total sample size of 91. Due to participants withdrawing from the study, a sample of 85 participants was used. The six participants who withdrew, had their data removed from the study.

Table 3.2 Demographic Information

		Group 1	Group 2	Total Sample
Gender	Female	43	25	68
	Male	10	7	17
Age	18-21	48	25	73
	22-42	5	7	12
Ethnicity	Caucasian	48	27	75
	Other	5	5	10
Year in School	Sophomore	33	18	51
	Junior	16	9	25
	Senior	3	3	6
	Graduate	1	2	3
Major	Elementary Education	28	13	41
	Secondary Education	21	16	37
	Other	4	3	7
Total Participants		53	32	85

Data Collection and Analysis

At the beginning of the Fall 2014 semester, preservice teachers enrolled in both course sections (referred to as group 1 and group 2) received a copy of the of the informed consent form. The researcher read the form to all participants (See appendix B). All participants were given time to read, ask questions, and sign or not sign the form. At that time, each participant received a copy of a demographic form (Appendix C) and the Group Embedded Figures Test

(GEFT). Students enrolling late in the course or who were absent the first day were given a make-up time to complete the consent and demographic forms, as well as the GEFT.

Pretest. Prior to unit 1: child development, unit 2: learning theories, and unit 3: assessment strategies, participants responded to a pretest for the respective unit to determine previous knowledge of content. This established a baseline for measuring differences in knowledge within and between the two course sections. At the end of each unit, participants received an assessment test over the content as a measure of academic achievement. The pretest averages for each class were be compared via a one-way ANOVA to set a baseline and to determine whether the two groups were the same. An eta-squared effect size was calculated to measure the size of significance in the one-way ANOVA (Levine & Hullett, 2006) with .01 being small, .06 medium, and .14 a large effect size (Morse, 1999).

Group Embedded Figures Test. As a modification of the original Embedded Figures Test (EFT), the Group Embedded Figures test (GEFT) was administered to participants during the first week of the semester. The test required participants to locate a simple figure within a more complex figure within a given time. The test, given in a booklet form, contained 25 questions broken into three sections. The first section, is a practice section and is given two minutes, while the two remaining sections, consisting of nine figures each, are both allotted five minutes for completion.

Scoring. Correct answers from the final two sections were given one point each, while omitted figures and incorrect answers received zero points. Points were totaled and located on a scale between 0 and 18 for each participant.

The GEFT has been tested multiple times for reliability and validity through different means. The GEFT is a timed test, so it was necessary for the creators to perform a correlation

between parallel forms with identical time limits so the first 9-item section and the second 9-item section was correlated and corrected by the Spearman-Brown prophecy formula with a reliability estimate of 0.82 (Witkin et al., 1971). Due to the nature of this test, as an adaptation of the original parent EFT, this parent test was used to calculate the validity. Male and female undergraduates' scores on the GEFT were correlated with criteria including the EFT, Rod-and-Frame test, and others *r*=-.82 male undergraduates, -.63 female undergraduates. The current issue of the GEFT manual has tables of norms for many countries, cultures, genders, levels, of school, and ages (Demick, 2014).

Participants' GEFT scores were analyzed to determine their field dependency score. A Pearson correlation coefficient was used to measure a relationship between cognitive style and academic achievement.

Academic Achievement Tests. Each unit had a corresponding assessment test from the textbook test bank (Woolkfolk, 2013), which was administered at the end of the unit. Validity and reliability of the original test questions are not reported in the test bank manual. The three unit assessments were compared by a one-way ANOVA. This study's design was set up to only look between two groups and not within groups, nor were they paired samples, so a one-way ANOVA was the best fit for the design over a repeated measures ANOVA. Similarly, only one independent variable was being measured to test the first hypothesis so rather than a factorial ANOVA, the one-way ANOVA was the best statistical test for this measurement. The two groups' average assessment score were compared across three units over the semester. An eta-squared effect size was calculated to measure the size of significance in the one-way ANOVA (Levine & Hullett, 2006) with .01 being small, .06 medium, and .14 a large effect size (Morse, 1999).

Projects and Presentations. At the beginning of the PBL instructional style unit, participants were given a hand-out containing information about PBL, the process for completing it in the class, and objectives guiding the learning process (see Appendix D for the PBL process). Throughout the semester, there were two incidences of PBL in which participants were required to complete a project and presentation demonstrating their knowledge of the teaching standard corresponding to the unit of study. This project was graded by a rubric, which was created by the participants as part of the social negotiation of curriculum. The projects resulting from PBL were referred to as another academic achievement score and were analyzed using an independent-samples *t*-test and Cohen's *d* was calculated for effect size.

Reflection Questionnaire. At the end of the course, each student were asked to reflect on their experiences and discuss their perceptions of the instructional styles used throughout the course; lecture and project-based learning (See appendix E for the reflection questionnaire) This reflection questionnaire served as an instrument for ascertaining participants thoughts and perceptions about their learning processes during different instructional styles.

Reflections were analyzed via a phenomenological approach. Because each participant had a different perspective and experiences throughout different phenomena, the purpose was to see individual differences among participants and to understand similarities and differences in perceptions. "Significant statements" were highlighted throughout the data (Creswell, 2013; Moustakas, 1994). A chi-square goodness of fit test was calculated comparing the frequencies of participant responses regarding the instructional style they

preferred and that they thought had the greatest impact on academic achievement. Effect size was calculated using Cohen's W with a .10 as small, .30 as medium, and .50 as large.

Chapter 4: Results

As described in Chapter III Methodology, two groups of students participated in two instructional styles of teaching throughout the semester, further called group 1 and group 2. Each group participated as both the control and the treatment group at different times during the semester. The control group was exposed to a lecture style environment where students were expected to listen and attend to PowerPoints, take notes, and participate in discussions; this is referred to as lecture instructional style. The treatment group participated in project-based learning (PBL) where students formed groups, negotiated curriculum, created projects, and presented their projects to the class; this is referred to as PBL instructional style. Participants also took the Group Embedded Figures Test (GEFT) to determine each student's level of field dependency. Data were collected from unit exams referred to as academic achievement scores, their GEFT scores, their academic achievement scores from projects completed during PBL, and student reflection questionnaires.

The data were used to test two hypotheses, to determine whether participating in a PBL instructional style achieved greater academic achievement scores on unit assessment tests than participants who were involved in a lecture instructional style. This hypothesis was measured using a one-way ANOVA with the critical level of significance set at 0.05. A one-way ANOVA was also used in measuring all students' pretest scores establishing that the two groups were probably equal. Secondly, the data were used to measure a relationship between an individual's field dependency cognitive style and their academic achievement during PBL treatments. The GEFT was used to assess participants' field dependency. A Pearson correlation was used to measure the relationship between field dependency and academic

achievement. Finally, an independent samples *t*-test was used to measure differences in academic achievement mean scores from projects between the two groups.

A one-way ANOVA was used to measure the differences between two groups in different treatments. This study was designed to only look between two groups and not within groups, nor were they paired samples, so a one-way ANOVA was the best fit for the design over a repeated measures ANOVA. Similarly, only one independent variable was being measured to test the first hypothesis so rather than a factorial ANOVA, the one-way ANOVA was the best statistical test for this measurement. The one-way ANOVA is a robust measurement accounting for differences in sample sizes and decreasing the chance of a type I error by keeping the significance level at 0.05 across the three factors. An eta-squared effect size was calculated to measure the size of significance in the one-way ANOVA (Levine & Hullett, 2006) with .01 being small, .06 medium, and .14 a large effect size (Morse, 1999).

An independent-samples *t*-test was used to measure differences between group 1 and group 2's academic achievement scores on their projects. This *t*-test was chosen because each group is independent of each other. While, the independent samples *t*-test is robust towards data not meeting assumptions, an independent samples *t*-test reading equal variances not assumed line makes corrections for not meeting the assumptions of unequal variances. This line was used for the *t*-test measurement. Effect size was calculated using Cohen's *d* with a .2 as small, .5 as medium, and .8 as large (Cohen, 1999).

In terms of qualitative data, a questionnaire was administered to ascertain the thoughts and experiences of participants during both lecture instructional style and PBL instructional style. Participants were asked which instructional style of teaching they preferred and which instructional style they thought had the greatest impact on their academic achievement. After

responding, participants were asked to describe their reasoning for their choice of which instructional style they preferred and the instructional style they thought had the greatest impact on their academic achievement. As each participant had different experiences throughout the course, the data were analyzed using a simple phenomenological approach by finding "significant statements" in their responses (Creswell, 2014; Moustakas, 1994).

This quasi-experimental design was a switching replications design to counter any differences existing between control and treatments groups. Such differences would be reversed during the second treatment period, see Table 4.1.

Table 4.1. Notation

	Unit 1 Child Development	Unit 2 Learning Theories	Unit 3 Assessment Strategies
Group1	Treatment	Control	Control
Group 2	Control	Control	Treatment

Further discussed in the participant section in Chapter III, the two groups being compared differed in number of participants. However the two groups were similar in their demographic information. At the beginning of the study, there was a total sample size of 91. Due to a 6% mortality rate, a sample of 85 participants was used. Data from the six participants who withdrew from the study, were removed.

Pretest Data

Pretests were administered for each of the three academic achievement measures throughout the semester to determine whether there were differences between the two groups regarding their understanding of unit 1 content prior to instruction. Both groups pretest raw scores were tested for significant differences using a one-way ANOVA.

The one-way ANOVA for pretest data compared the means of the two groups and determined there was no significant difference in participants' understanding of unit 1 child development ($F(1, 83) = .43$, $p = .02$), unit 2 learning theories ($F(1, 83) = .11$, $p = .96$), and unit 3 assessment strategies ($F(1, 83) = .19$, $p = .04$). Mean and standard deviation scores of participant understanding are presented in Table 4.2, frequencies are presented in Table 4.3. Each pretest had seven questions representing content that was discussed during each of the three units.

Table 4.2. Pretest: Mean Scores

	Unit 1: Child Development		Unit 2: Learning Theories		Unit 3: Assessment Strategies	
	m	*sd*	*m*	*sd*	*m*	*sd*
Group 1	3.26	1.04	3.02	0.99	3.0	1.24
Group 2	3.09	1.32	3.09	1.08	3.13	1.39

Table 4.3. Pretest Frequencies

Pretest		Group 1(n = 53)		Group 2 (n = 32)	
Unit 1		Frequency	Percentage	Frequency	Percentage
	0-1	2	3.8	5	15.6
	2-3	31	58.5	13	40.6
	4-5	19	35.8	14	43.8
	6	1	1.9	0	0
Pretest	0-1	3	5.7	1	3.1
Unit 2	2-3	33	62.3	21	65.6
	4-5	17	32.1	9	28.1
	6	0	0	1	3.1
Pretest	0-1	4	7.5	4	12.5
Unit 3	2-3	33	62.3	15	46.9
	4-5	14	26.4	12	37.5
	6	2	3.8	1	3.1

Unit Assessment Tests

Unit assessments were used to score academic achievement and to test the first hypothesis of this study. This was achieved by comparing the treatment and control groups'

mean scores for unit assessment tests. It was predicted the mean score of the participants immersed in PBL instructional style would be greater than the participants' mean score who were immersed in the lecture instructional style. A one-way ANOVA was used to test the null hypothesis.

The first null and alternative hypotheses are:

- $H1_0$: Participants who engaged in project-based learning will have the same mean academic achievement test score than participants who received lecture instructional style.
- $H1_1$: Participants who engaged in project-based learning will have a significantly higher mean academic achievement test score than participants who received lecture instructional style.

The results of the one-way ANOVA are presented in table 4.4 and discussed below.

Table 4.4 ANOVA

	Unit 1: Child Development		Unit 2: Learning Theories		Unit 3: Assessment Strategies	
	m	*sd*	*m*	*sd*	*m*	*sd*
Group 1	82.75	12.66	78.49	12.62	77.08	12.66
Group 2	76.47	8.68	78.63	9.71	82.72	11.77

Unit 1. Within the first unit of study, child development, group 1 received the treatment of a PBL instruction, while group 2 received lecture instructional style. The one-way ANOVA indicated a significant difference in academic achievement scores. The treatment groups' mean was significantly greater than the control groups' mean scores ($F(1, 83) = 5.54$, $p = .02$) with a medium eta squared effect size of .06.

Table 4.5 Academic Achievement Test Unit 1 Frequencies

Unit 1		Group 1		Group 2	
	Range	Frequency	Percentage	Frequency	Percentage
	0-55	1	1.9	0	0
	56-60	2	3.8	0	0
	61-65	2	3.8	4	12.5
	66-70	4	7.5	6	18.8
	71-75	4	7.5	1	3.1
	76-80	10	18.9	12	37.5
	81-85	6	11.3	4	12.5
	86-90	8	15.1	4	12.5
	91-95	9	17	1	3.1
	96-100	7	13.2	0	0
	Total	53	100	32	100

Unit 2. During the second unit of study, learning theories, both groups 1 and 2 received the control of lecture instructional style. The one-way ANOVA concluded no significant difference between the two groups ($F(1, 83) = .01$, $p = .96$).

Table 4.6 Academic Achievement Test Unit 2 Frequencies

Unit 2		Group 1		Group 2	
		Frequency	Percentage	Frequency	Percentage
	0-50	2	3.8	0	2
	51-55	0	0	1	3.1
	56-60	3	5.7	0	0
	61-65	1	1.9	0	0
	66-70	9	17	5	15.6
	71-75	4	7.5	7	21.9
	76-80	10	18.9	7	21.9
	81-85	6	11.3	10	31.3
	86-90	9	17	4	12.5
	91-95	5	9.5	1	3.1
	96-100	4	7.5	2	6.3
	Total	53	100	32	100

Unit 3. Within the third unit of study, assessment, group 2 received the treatment of PBL instructional style, while group 1 received the control of lecture instructional style. A

one-way ANOVA test compared the mean test scores for both groups and indicated a significant difference in their academic achievement scores where the treatment groups' mean was significantly greater than the control groups' mean score ($F(1, 83) = 4.17$, $p = .04$) with a small eta squared effect size of .05.

Table 4.7 Academic Achievement Test Unit 3 Frequencies

Unit 3		Group 1		Group 2	
		Frequency	Percentage	Frequency	Percentage
	0-50	3	5.7	0	0
	51-55	0	0	0	0
	56-60	2	3.8	3	9.4
	61-65	3	5.7	0	0
	66-70	7	13.2	5	15.6
	71-75	7	13.2	1	3.1
	76-80	4	7.5	3	9.4
	81-85	9	17	5	15.6
	86-90	16	30.2	7	21.6
	91-95	4	7.5	3	9.4
	96-100	1	1.9	5	15.6
	Total	53	100	32	100

The statistical findings are significant and provide evidence for rejecting the #1 null hypothesis and accepting the first alternative hypothesis.

Field Dependency

The Group Embedded Figures Test (GEFT) was administered to provide a field dependency score for each participant. GEFT scores were assigned to every participant and used to test the second hypothesis of this study. This was achieved by correlating participants' GEFT score to their academic achievement scores while engaged in PBL. It was predicted the GEFT scores of the participants would have a significant correlation with their academic achievement score while engaged in PBL. A Pearson correlation test was conducted to determine the probability that a significant correlation did not occur by accident.

The second null and alternative hypotheses are

- $H2_0$: There is no correlation between a participant's field dependency and his or her academic achievement test score after engaging in project-based learning instructional style.
- $H2_1$: There is a significant correlation between a participant's field dependency and his or her academic achievement test score after engaging in a project-based learning instructional style.

Field Dependency Results. A Pearson correlation was calculated examining the relationship between participant's GEFT scores and their academic achievement test scores while engaged in PBL. No significant correlation was found for exam 1 when group 1 received the treatment PBL instructional style ($r(51) = .24$, $p = .08$). No significant correlation was also found for exam 3 when group 2 received the treatment of PBL instructional style ($r(30) = .10$, $p = .59$). See Table 4.7 with for GEFT score frequencies. This correlation suggests participants' field dependency is not related to their academic achievement during PBL and the second null hypothesis should be retained.

Table 4.8. GEFT Scores

GEFT		Group 1		Group 2	
		Frequency	Percentage	Frequency	Percentage
	1-3	2	3.8	0	0.0
	4-6	5	9.4	3	9.4
	7-9	9	17.0	6	18.8
	10-12	6	11.3	6	18.8
	13-15	21	39.6	13	40.6
	16-18	13	24.5	4	12.5
	Total	53	100	32	100

Project Academic Achievement Scores

During PBL instruction, students had the option of working together in groups to create a project and a presentation to the class on their project. Part of the PBL instructional style involves collectively creating a rubric for assessing and evaluating the outcome of group projects and presentations. The rubric, was created by the students, to yield an academic achievement score for PBL projects and presentations. See Appendix F for student rubrics. Levene's test for equality of variances was found to be violated for this independent samples *t*-test ($F(1, 83) = 6.29$, $p = .01$). Due to this violation, the equal variances not assumed line was read for significance. No significant difference was found between the two groups ($t(47.46) = -1.15$, $p = .26$, $d = .27$). The mean of group 1's PBL academic achievement score ($m = 89.5$, $sd = 2.49$) was not significantly different from the mean of group 2's PBL academic achievement score ($m = 90.36$, $sd = 3.77$). A small 0.27 Cohen's *d* effect size was found. The non-significant *t*-test indicates the two groups' mean academic achievement scores for their projects were probably equal. See Table 4.8 for project and presentation score frequencies.

Table 4.9. Project Score

Project Scores		Group 1		Group 2	
		Frequency	Percentage	Frequency	Percentage
	0-80	1	1.9	0	0
	81-85	1	1.9	4	12.5
	86-90	26	49.1	9	28.1
	91-95	29	54.7	17	53.1
	96-100	0	0	1	3.1
	Total	53	100	32	100

Review of Quantitative Data

Statistical testing of academic achievement pretest data suggested no significant difference between the control and treatment groups with regard to their previous knowledge of unit 1 child development, unit 2 learning theories, and unit assessment strategies. Although the two groups differed in number, their mean scores were probably equal.

Testing the first hypothesis, the academic achievement scores indicate statistically significant differences between control and treatment groups. Participants within a PBL environment yielded greater academic achievement mean scores based on the unit assessment tests than those participants in a lecture format instructional style. Based on these findings, the first null hypothesis was rejected, indicating participants engaged in PBL were able to better perform on their academic achievement tests. Although a small and medium effect size were found, there is practical significance in using PBL as an effective instructional style.

To test the second hypothesis, a Pearson correlation was used to explore a relationship between participants GEFT scores and academic achievement while engaged in PBL. Neither of the groups' correlations were significant, suggesting participants' level of field dependency is not related to their academic achievement while engaged in PBL instructional style.

To explore differences between groups' project academic achievement scores, an independent samples *t*-test was utilized. No significant difference was found indicating the two groups' mean academic achievement scores for their projects were probably the same.

Participant Projects and Presentations

Participants provided a number of different projects and presentations as a result of engaging in PBL instructional style. Most students created a PowerPoint or Prezi with information they learned about their topic which included in-class activities, polls, and/or

videos demonstrating their concepts. Some groups created projects that deviated from PowerPoints and Prezis. One group created different lesson plans on the same topic, but with different cooperative learning instructional styles. Another group taught a lesson on the Civil War and assessed students before, throughout, and after their lesson to demonstrate different types of assessments. A group of one student made a video where she drew the information on a white board while she was talking about the information. Another group created scenarios and made videos of themselves acting out different aggression situations. Other groups had their peers take online learning style and IQ quizzes while some demonstrated Piaget's Concrete Operational tasks (e.g. pouring equal amounts of liquids into various sized glasses).

While final projects and presentations were based on the decision of the PBL group members, the only requirement from the instructor was that students utilize some kind of information technology. Many groups relied on instructional strategies they are familiar with, like PowerPoints/Prezis, some students used other types of technology (e.g. cell phone survey technologies and Youtube videos).

Participant Reflection Questionnaires

In order to determine the thoughts and experiences of participants engaged in both the lecture instructional style and PBL instructional style, a research questionnaire was employed (See Appendix C for Questionnaire). Participants were asked which instructional style of teaching they preferred and which instructional style they thought had the greatest impact on their academic achievement. After responding, participants were asked to describe their reasoning behind selecting that preferred instructional style and selecting the instructional style they thought had the greatest impact on their academic achievement.

Responses were analyzed using a simple phenomenological approach by finding "significant statements" from their explicit reasoning (Creswell, 2014; Moustakas, 1994). Questionnaires were optional, however 100% of the 85 participants responded. The results were pooled across and between sample groups and totaled for frequency counts.

When asked which instructional style students preferred throughout the semester, n = 52: 61% of students agreed lecture instructional style was their preferred instructional style. Responses for choosing lecture instructional style included "it was easier to follow along and take notes," "Lecture is just what I'm used to," and "I know exactly what would be on the test." While these were the most common phrases, many students also felt the lectures were interactive and engaging throughout the semester.

Thirty-nine percent (n=33) of students described PBL as their preferred instructional style of study throughout the semester. Their responses included "we were forced to learn the material which helped us to remember the information," "we could be active in what we were learning," and "information was presented in different ways and from different people with different knowledge and experiences." Many students described PBL instructional style as a way to be creative and in-charge of their learning process.

The second question participants were asked which instructional style of teaching they thought had the greatest impact on their academic achievement. Many participants chose a different answer than their preferred instructional style.

Twenty-six percent (n=22) of participants indicated they learned more from lecture instructional style. They responded "lectures were good and interactive," "information was directly taught," and "I just learn better that way." Seventy-four percent (n=62) of participants expressed they learned more while engaged PBL instructional style, with many

responses including “we could connect and apply the information we were learning.” Other responses included, “the information was relevant and I could connect it to the real world,” “we were engaged and could go in-depth into the information,” and “presenting the information was helpful to us as future teachers.” Many participants mentioned the ability to be creative and active helped their learning processes, which helped them remember the information better for the unit assessment test. A detailed description of responses is presented in Table 4.10.

A chi-square goodness of fit test was calculated comparing the frequencies of responses to the instructional style participants preferred and thought had the greatest impact on their academic achievement. A significant deviation from expected values was found for preferred instructional style ($x^2(1) = 4.25$, $p = .04$) and for instructional style having greatest impact on academic achievement ($x^2(1) = 19.78$, $p < .001$). Effect size was calculated using Cohen’s W with a .10 as small, .30 as medium, and .50 as large. Effect size values were .22 small-medium for preferred instructional style and .48 medium-large for instructional style having greatest impact on academic achievement.

While many students indicated they preferred lecture to project-based learning, a higher percentage of students said they learned more information from working together as a class and completing PBL projects and presentations. These answers are indicators of what instructional style students may prefer in their college courses. Both the qualitative and quantitative results show significant differences between PBL instructional style and lecture instruction style. There are many points for an instructor to consider while planning higher education courses that are discussed further in chapter 5.

Table 4.10. Questionnaire Responses

		Frequency	Percentage	Reasoning
Preferred Instructional Style of Teaching	Lecture	52	61%	I knew what would be on the test (18) It was easier to take notes (14) It is what I'm used to (14) Lectures were good and interactive with examples (11) Lecture is less personal work (8) Lecture was consistent (5)
	PBL	33	39%	We were active in our own learning (16) We were forced to learn the material which helped us remember (15) I found my own way of understanding the concepts (9) Information is presented in different ways with different knowledge bases (8) We could be creative (8) We could practice teaching (7) It was easier to connect to our lives (5)
Instructional style of Teaching With the Greatest Impact on Academic Achievement	Lecture	22	26%	Lectures were good and interactive with examples (10) Information was directly taught (7) I understand it better (6)
	PBL	63	74%	We could connect and apply the information we were learning (31) It was relevant to the real world (16) Teaching it to others was helpful (14) We were engaged and could go in depth into the information (11) I remember the information a lot better (11) We could be active and creative (11)

Chapter 5: Conclusion

Little research on the effectiveness of using project-based learning (PBL) with information technology in higher education courses can be found. A review of the literature found only one study examining a relationship between PBL and field dependency cognitive style. With the frequency of higher education courses being taught via lecture instructional style, it is difficult to measure the amount of information students can apply from what they have learned (Lammers & Murphy, 2002). Despite this detail, many researchers have shown active learning strategies can improve academic achievement, engagement, and knowledge (Cherney, 2008; Yoder & Hochevar, 2005; Sivan, Leung, Woon, & Kember, 2000).

This study examined the effect project-based learning had on academic achievement in a teacher education development, learning, and assessment course. A quasi-experimental switching replication design was used, in which two class sections of the undergraduate course were employed as control and treatment groups. They are referred to as group 1 and group 2. The semester coursework was divided into three units addressing child development, learning theories, and assessment strategies. During the first unit, group 1 was the treatment group receiving PBL instruction while group 2 acted as the control group receiving lecture instructional style. In the second unit of the semester, both groups participated in lecture instructional style. During the final unit of the semester, group 2 was the treatment group that participated in PBL, while group 1 was the control group and participated in lecture instructional style. Each of the 85 participants completed the Group Embedded Figures Test (GEFT) earning a field dependency score and completed a reflection questionnaire inquiring about preferences and perceptions of instructional styles used throughout the semester.

Results of this study reveal that PBL with information technology increases academic achievement when compared to lecture instructional style. Participants' field dependency cognitive style had a small positive correlation with the academic achievement scores during PBL instruction. Participants indicated they preferred lecture instructional style stating it is easier, while they described PBL to have more of an impact on their learning and academic achievement.

Project-Based Learning

The first hypothesis in this study was designed to determine whether PBL with information technology had a significant effect on academic achievement. That is, were students able to achieve greater tests scores on unit assessment tests from the textbook test bank when they were involved in PBL instruction versus lecture instructional style. For unit 1, child development, group 1 participated in PBL instructional style and they produced greater academic achievement scores on their unit assessment test than participants receiving lecture instruction style ($F(1,83) = 5.54$, $p = .02$). For unit 3 assessment strategies, group 2 participated in PBL instructional style and they also earned greater academic achievement scores on their unit assessment test that participants receiving lecture instructional style ($F(1,83) = 4.17$, $p = .04$).

These results align with the review of literature. Most studies discuss the benefits of using PBL instructional style in regards to higher academic achievement when compared to lecture (Barron et. al., 1998; Frank & Barzilai, 2004; Beckett & Miller, 2006; Boaler, 2002; Geier et al., 2008; Mergendoller, Maxwell, & Bellisimo, 2006). While those studies focused on PBL mostly in the K-12 classroom, PBL has also been shown to be effective in higher education (Barak & Dori, 2005; Smith, 1998; Hogg, 1991; Gulbahar & Tinmaz, 2006;

Roberts, 2005). Within the realm of teacher education programs, most studies focused on whether preservice teachers learned from completing projects and investigate future classroom utilization of PBL, rather than if performance on academic achievement assessments was increased (Franklin & Molebash, 2007; Reis & Karadag, 2009; Frank & Barzilai, 2004; Masats & Dooly, 2011). This study concludes similar results to the literature. Project-based learning is an effective instructional style in higher education and it produces higher academic achievement test results among participants than those who receive the lecture instructional style.

Field Dependency Cognitive Style

The second hypothesis tested a relationship between field dependency cognitive style and PBL academic achievement scores. It was predicted there would be a significant correlation between a participant's field dependency cognitive style and his or her achievement test scores while engaged in PBL. Results show no significant correlation (group 1 ($r(51) = .24$; group 2 ($r(30) = .10$) between a participant's field dependency score and his or her score on the assessment test. This result, although non-significant, is important for educators to understand. Since an individual's cognitive style did not show a relationship with their academic success while engaged in PBL, students with various levels of field dependency can succeed on assessments while participating in PBL. While Roberts (2005) showed a relationship between cognitive style and PBL in students who were just beginning an architecture program, this study was unable to show a significant correlation between participants' field dependency and academic achievement. Roberts suggests early in education, students who are more holistic thinkers perform less well when compared to other thinkers, but improve later on throughout their program. Based on this evidence, it can be

argued that by tracking students, one may be able to see students' cognitive styles change as they develop as independent learners. Due to the nature of testing cognitive style and its effect on academic achievement at a given time, students' academic achievement scores could be different earlier on in their education. Similarly, it can be argued different disciplines are more susceptible to field dependency cognitive styles, such as hands-on learning that occurs in architecture courses.

Participant Reflections

A third part if this study questioned participants experience and perceptions about instructional styles throughout the semester. One of the more telling aspects of this study were the responses from participants. Having been asked whether they preferred PBL with information technology or lecture instructional style, 61% stated they preferred lecture because it was easier and they knew what would be on the test. Participants were also asked which instructional style they thought had more impact on their learning. Seventy-four percent of participants mentioned they thought PBL had helped them learn more stating they could connect and apply the information to their lives, as well as be interactive. Though most participants suggested they learn more from PBL, they still prefer lecture stating it is less work and easier to find the information.

This finding raises a concern for higher education in general. Students knowing and believing they learn more while being cooperative and learning through a PBL instructional style still would choose lecture instruction as they perceived it as less work. This could be an issue for the future of higher education courses. Most undergraduate courses utilize lecture-based instruction (Lammers & Murphy, 2002; Thielens, 1987) even though research suggests active learning strategies help students learn and retain more information (Cherney, 2008;

Yoder & Hochevar, 2005; Sivan, Leung, Woon, & Kember, 2000; VanderStoep, Fagerlin, & Feenstra, 2000; Chickering & Gamson, 1987). Implications of this finding extend to course enrollment in where students might choose courses utilizing lecture instructional style rather than a collaborative or PBL instructional style. Similarly, students enrolled in courses using collaborative and PBL instructional style might evaluate the course based on the instructional style, rather than the content they are learning. This could result in lower instructor and course evaluations.

Participant Projects and Presentations

Finally, participants in this study presented their project to the rest of the participants. Each group created a rubric to use for the evaluation process which resulted in a PBL project academic achievement score (see appendix F for group rubrics). The rubrics differed in the number of points allocated for each criteria, however the criteria remained consistent; the two groups' PBL project and presentation scores were not significantly different ($t(83) = -1.27$, $p = .26$).

The PBL projects created by participants varied with regard to content, presentation, and technology. Participants utilized various means of information technology including PowerPoint or Prezi presentation software, videos, online polls, and interactive websites.

Differences in the projects were expected, as the content, technology, and presentation were chosen by the participants. While some participants created an exciting lesson for teaching their topic, others relied on methods of presenting they are accustomed to using and seeing in their college courses (Bird, Anderson, Sullivan, & Swidler, 1993; Holt-Reynolds, 1992). Research suggests preservice teachers will teach their students the way they were taught (NCTAF, 1996), this phenomenon raises concern for teacher educators who educate

and train future teachers. This study suggests, even though PBL may lead students to choose other courses with lecture instructional style, teacher educators should consider future generations of students, and their student's students. Teacher educators should utilize PBL instructional styles, known to that produce higher academic achievement scores, even though PBL may affect the instructor's course evaluations.

Biases and Threats to Validity

In this study there were several threats to validity; both internal and external. Within the design of the study, it was the goal to minimize internal threats and decrease other possible causes for a change in the observations. Many participants probably completed an introduction to psychology or a previous education course, so there is a strong historical threat to internal validity, which was addressed by administering a pretest at the beginning of each unit. A testing threat to validity was avoided by employing a small subset of questions similar to the unit achievement test questions from the textbook test bank (Woolfolk, 2013). Questions on the pretest assessed the same ideas and concepts, but in different forms than the unit achievement tests. Due to an equivalent form of the unit test being used as a pretest, an instrumentation threat becomes apparent. An instrumentation threat was minimized by utilizing the course textbook's test bank provided by the publisher of the text (Woolfolk, 2013) to ensure quality and scope.

As with any research study, a mortality threat was apparent and was addressed by removing a participant's data when he or she rejected participation permission. A final threat to internal validity is a threat of regression to the mean. If participants score extremely low on a pretest, their scores will most likely improve in general, showing a difference in pretest

and posttest scores. Regression to the mean was minimized by replicating the pretest/posttest concept three times throughout the semester.

Among the internal design threats, this study recognizes social threats to internal validity as well. There was a probability participants, either directly or indirectly, became aware they were part of a control group. This diffusion threat was minimized by having a switching-replications design which gives both groups of participants the chance to be the control and the treatment group. As the Hawthorne effect describes, students may perform differently because they know they are part of a research project. A Hawthorne effect was also minimized by having a switching-replications design and by the time the students participated in the different aspects of the class, they had admittedly forgotten research data was being collected. Students knew they were expected to complete the assignments as part of the course, not necessarily for research purposes.

A quasi-experimental design poses threats to external validity. Ecological validity was addressed and minimized by utilizing one administrator for both treatments. In the project-based learning treatment, the instructor was teaching both sections of the course and administering project-based learning in the same manner. It is noted that the instructor recognizes a threat of understanding how to better administer project-based learning towards the end of the course with the second treatment group. This was minimized by following the same procedures, guidelines, and instructions as the first treatment group.

Limitations to the Study

As with any research, this study has limitations. Limitations are characteristics influencing the findings of a study and may affect the results and generalizability. A first limitation were demographic variables. Although the course in which the study took place is

primarily for undergraduate beginning preservice teachers, the course is offered to any students enrolled at the university. This resulted in a course enrollment variety containing mostly education majors, graduate students, non-traditional students, and non-education majors. Most of the graduate students have an undergraduate degree in a discipline other than education, while a couple non-traditional students had experience working with students in and outside of the classroom or raising children. The students from different majors were interested in the material presented in the course. All three of these groups expressed excitement to the instructor towards the course and the information.

Another limitation was some students may prefer to work alone as opposed working a group. Although working in a group of one was an option, some participants could have felt obligated or pressured to work with other people. While the groups often worked isolated from one another, class time was available for groups to interact with one another regarding their topic.

The next limitation was the possibility participants wanted to please the instructor on their reflection questionnaire responses. These were self-reports so some students may have said they prefer or thought they learned more from PBL because it was something the instructor was studying or excited about.

Another limitation was the physical classroom. Students relied on their own technology and resources and the classroom was not set up in a collaborative fashion. With a media cart, projector screen, and white board at the front, there were permanent rows of small chairs with foldable desks the size of an 8x10 inches piece of paper.

A final limitation was the instructor. While the same instructor was utilized across the two groups, it was her first time using a PBL instructional style in higher education. Being

new to the method could have altered how it was explained to the students and conducted in the classroom. Another factor is the excitement level and procedure of the lectures. The instructor may have shown more excitement towards one instructional style, as well as, created lectures that were interactive.

Significance of Research

Many researchers suggest using active learning strategies including project-based learning with information technology in higher education classes will probably increase academic achievement (Barak & Dori, 2005; Smith, 1998; Hogg, 1991; Gulbahar & Tinmaz, 2006; Roberts, 2005; Cherney, 2008; Yoder & Hochevar, 2005; Sivan, Leung, Woon, & Kember, 2000). The results of this study agree with the literature. PBL is a valuable and effective instructional style.

PBL helps students to become active in their learning by working together, making decisions, co-constructing their knowledge, and creating a shared experience (Adderley, et al., 1975; Vygotsky 1978; Moursund, 2001). Ted Panitz (2005) describes collaborative learning as a philosophy where people work together in a group. Cooperative learning is the framework of how people work together; it happens inside a collaborative learning environment. The idea of these types of social interactions promote critical thinking skills, the ability to think creatively, solve problems, make decisions as a team, and improve learning (Gokhale, 1995). Vygotsky (1978) suggested students can perform at higher intellectual levels during collaborative group activities. The more diverse that group is, the more learning occurs. Cooperative learning promotes problem solving because students need to make a decision and come to a conclusion (Bruner, 1985). Johnson, Johnson, and Smith (1991) explain basic elements of cooperative learning groups as face-to-face interaction, social skills,

positive interdependence, group process skills, and individual accountability. Enabling collaborative learning means students will gain skills and knowledge they can transfer to other learning situations and opportunities (Moreland & Argote 2000; Dillenbourg, 1999; Weinberger, Fischer, & Mandl, 2002).

Research suggests a students' level of field dependency is not related to the outcome of PBL and academic achievement is important for instructors to know. As suggested by this study, PBL should be effective in increasing levels of academic achievement regardless of a student's field dependency. PBL should work well for every student.

Finally, most participants indicate a preference for lecture instructional style, yet they state they learn more via PBL. An instructor who sets goals of making a classroom more collaborative and active could have students who prefer not to participate and who would rather listen to someone tell them information, making planning and teaching frustrating. Instructors might receive negative feedback from those students regarding their instructional style. It is important to think of what has influenced the students' thoughts for preferring lecture; an instructor could explore the reasons students want to enroll in the 'easy way' of learning. As indicated by the participant's responses, they prefer a lecture stating they are given the exact information they will need to know for the exam. What leads students to only be concerned with what will be tested on a high pressure exam?

Suggestions for Future Research

This study began to explore the effectiveness of project-based learning with information technology on preservice teachers' academic achievement. Due to the few studies in this discipline, there are many suggestions for future research.

First and foremost, PBL should be evaluated in different content areas, both within education and outside of education. This study took place in a beginning theory course, students may change throughout their tenure in the education program. So PBL instructional style should be researched in content methods courses later on in student's teacher education program. Along similar lines, tracking preservice teachers as they become inservice teachers could offer insight into their consideration of utilizing PBL as an effective pedagogy in their future classrooms. Some research has been conducted in other areas such as chemistry (Barak & Dori, 2005), statistics (Smith, 1998; Hogg, 1991), computer science (Gulbahar & Tinmaz, 2006), and architecture (Roberts, 2005) so there could be studies involving different content areas.

Exploring demographic variables such as age, gender, experience, level of school, major, or program, and PBL could help to find differences in the interest and effectiveness of PBL. Similarly, a different cognitive style measure could be utilized. Field dependency was chosen for the current study and showed no significant correlation between cognitive style and academic achievement. However, a future study could investigate a different cognitive, personality, or learning style. This research could help broaden the scope of knowledge about PBL effectiveness and also help classroom teachers plan their curriculum and instruction.

This study used a sample size of 85 where one group had 53 and the other had 32. Investigating different class sizes could provide information for higher education instructors to know the effectiveness of using PBL in large or small class sizes. This would help those planning for instruction to know how many is too many.

A final suggestion is the exploration of group dynamics. Within each group, each student brings their own knowledge and experience, as well as, how they interact with their

peers. This is an opportunity to qualitatively explore group and individual process. Interviews, recording their conversations, and having them discuss their experiences could benefit what scholars know about group dynamics.

Summary

Results of this study can be summarized into three general ideas. First, PBL is an effective collaborative tool to increase academic achievement when compared to lecture instructional styles. Secondly, PBL instructional style should increase academic achievement scores regardless of a student's field dependency level. Finally, although participants recognize the benefit of higher academic achievement scores from PBL instructional style, they state they prefer to listen to a lecture.

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Appendix A
IRB Approval

University *of* Idaho

Office of Research Assurances
Institutional Review Board
875 Perimeter Drive, MS 3010
Moscow ID 83844-3010
Phone: 208-885-6162
Fax: 208-885-5752
irb@uidaho.edu

To:	Paul Gathercoal
From:	Traci Craig, Ph.D., Chair, University of Idaho Institutional Review Board University Research Office Moscow, ID 83844-3010
Date:	7/14/2014 3:43:25 PM
Title:	Influences of Project-Based Learning and Field Dependency on Academic Achievement with Beginning Preservice Teachers
Project:	14-309
Certified:	Certified as exempt under category 1 at 45 CFR 46.101(b)(1).

On behalf of the Institutional Review Board at the University of Idaho, I am pleased to inform you that the protocol for the above-named research project has been certified as exempt under category 1 at 45 CFR 46.101(b)(1).

This study may be conducted according to the protocol described in the Application without further review by the IRB. As specific instruments are developed, modify the protocol and upload the instruments in the portal. Every effort should be made to ensure that the project is conducted in a manner consistent with the three fundamental principles identified in the Belmont Report: respect for persons; beneficence; and justice.

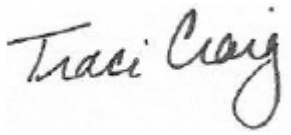
It is important to note that certification of exemption is NOT approval by the IRB. Do not include the statement that the UI IRB has reviewed and approved the study for human subject participation. Remove all statements of IRB Approval and IRB contact information from study materials that will be disseminated to participants. Instead please indicate, 'The University of Idaho Institutional Review Board has Certified this project as Exempt.'

Certification of exemption is not to be construed as authorization to recruit participants or conduct research in schools or other institutions, including on Native Reserved lands or within Native Institutions, which have their own policies that require approvals before Human Subjects Research

Projects can begin. This authorization must be obtained from the appropriate Tribal Government (or equivalent) and/or Institutional Administration. This may include independent review by a tribal or institutional IRB or equivalent. It is the investigator's responsibility to obtain all such necessary approvals and provide copies of these approvals to ORA, in order to allow the IRB to maintain current records.

As Principal Investigator, you are responsible for ensuring compliance with all applicable FERPA regulations, University of Idaho policies, state and federal regulations.

This certification is valid only for the study protocol as it was submitted to the ORA. Studies certified as Exempt are not subject to continuing review (this Certification does not expire). If any changes are made to the study protocol, you must submit the changes to the ORA for determination that the study remains Exempt before implementing the changes. Should there be significant changes in the protocol for this project, it will be necessary for you to submit an amendment to this protocol for review by the Committee using the Portal. If you have any additional questions about this process, please contact me through the portal's messaging system by clicking the ‘Reply’ button at either the top or bottom of this message.



Traci Craig, Ph.D.

Appendix B:
Student Informed Consent Form

Study: Influences of Project-Based Learning and Field Dependency on Academic Achievement with Beginning Preservice Teachers
Investigator: Susan Kologi
Faculty Sponsor: Dr. Paul Gathercoal, Curriculum and Instruction Department Chair

The University of Idaho Institutional Review Board has approved this project.
Office of Research Assurances, University of Idaho, PO Box 443010, Moscow, ID 83844-3010, hac@uidaho.edu,(208) 885-6162

Please read the following material that explains this research study. Signing this form will indicate that you have been informed about the study and that you want to participate. We want you to understand what you are being asked to do and what risks and benefits—if any—are associated with the study. All work you will complete is a requirement of the course.

Purpose: The purpose of this study is to explore effects on academic achievement with a project-based learning pedagogy and if cognitive thinking style is associated with project-based learning outcomes and academic achievement with beginning pre-service teachers' enrolled in EDCI 301: Learning, Development, and Assessment Fall 2014. As part of the study, you will be asked to record your demographic information, and take a survey, among the other assessments used within the course. You will not be asked to complete work that is not a requirement of the course.

Risks: There are no risks associated with this study that are not normally found in a regular classroom or in day-to-day living. None of the tasks in this study are designed to be physically or mentally uncomfortable. During this study, you may stop at any time with no penalty. Participation in the study has no effect on your grades in the course.

Confidentiality: The information collected during this study will be kept confidential. Only the researcher will be able to connect your information to your name, but each student will receive a number for pre/post identification purposes. All information will be stored on a password-protected computer in a secure room and in a locked drawer. Results from this study may be published for scientific purposes, but will be published only in group format. No information about you alone will be published. Publications will never include your name.

Questions: You may ask questions about the study at any time during your participation. Any questions you may have after you have participated should be directed to the researcher, Susan Kologi. She may be contacted at any time during or after the course at susankologi@vandals.uidaho.edu.

Withdrawal: You are free to withdraw your consent and discontinue participation in this research at any time without penalty. If you are uncomfortable with participation, all you need to say is, "I no longer wish to participate."

You are not waiving any legal rights by signing this form.

I have reviewed this consent form and understand and agree to its contents.

Consent of Participant

_____	_____
Signature of Participant	Date
_____	_____

Appendix C:
Student Demographic Form

Student ID #: _____

Gender: _____

Age: _____

Major (Please circle):

Early Childhood Elementary Education Secondary Education K-12

Area of specialization (i.e., English, Music, etc.) _____

If <u>not</u> an education major, please specify: _____

Year in University (Please circle):

Freshman Sophomore Junior Senior Graduate

Which group of people do you identify with please identify the specific group in the space provided:

Caucasian

Asian American (Chinese, Japanese, Korean, etc.)_____

African American

American Indian (Nez Perce, Coeur d'Alene, Shoshone, Bannock, etc.)_____

Pacific Islander (Hawaiian, Samoan, Guamanian, etc.)_____

Alaskan Native (Inuit, Klinguit, etc.)_____

Latino (Mexican, Cuban, Puerto Rican, Nicaraguan, etc.)_____

More than one: _____

Other _____

Please circle the following courses you have taken or are currently taking:

EDCI 201 EDSP 300 PSYC 101 PSYC 305

Appendix D:
Overview of Project Based Learning

You will complete ***project-based learning*** **(PBL)** ***using information technology*** for the third unit of the semester. You will generate products, presentations, and/or performances that demonstrate mastery of the course topic of development including some form of technology usage.

Group 1: You will be completing a project demonstrating your knowledge and master of Idaho Teacher Preparation *Standard 1:* ***Learner Development****. The teacher understands the many ways how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.*

Group 2: You will be completing a project demonstrating your knowledge and master of Idaho Teacher Preparation 6. ***Assessment****. The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making. The teacher understands and uses formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social, and physical development of the learner.*

PBL is an individual or group activity that goes on over a period of time, resulting in a product, presentation, or performance. Your project and presentation needs to demonstrate to your group, peers, and the instructor that you have mastery of your standard.

Detailed Definition of PBL

The general idea is that PBL is a multi-goaled activity that goes on over a period of time, resulting in a product, presentation, or performance. Typically PBL has milestones and other aspects of formative evaluation as the project proceeds. There is considerable focus on students understanding what it is they are doing, why it is important, and how they will be assessed. Indeed, students may help to set some of the goals over which they will be assessed and how they will be assessed over these goals. All of these learner-centered characteristics of PBL contribute to learner motivation and active engagement. A high level of intrinsic motivation and active engagement are essential to the success of a PBL lesson.

<u>From the student point of view. PBL:</u>
Is learner centered
Encourages collaboration and cooperative learning.
Requires students to produce a product, presentation, or performance.
Allows students to make incremental and continual improvement in their product, presentation, or performance.
Is designed so that students are actively engaged in "doing" things rather than in "learning about" something.
Is challenging, focusing on higher-order knowledge and skills.

From the teacher point of view, PBL:
Has authentic content and purpose.
Uses authentic assessment.
Is teacher facilitated--but the teacher is much more a "guide on the side" rather than a "sage on the stage."
Has explicit educational goals.
Is rooted in constructivism (a social learning theory)
Is designed so that the teacher will be a learner, learning from and with the students.

What it will look like for us:

Each day you come in, you should have your text, access to the internet, and any resources you've found to learn about the topics of development. You will have the class time to work in your groups, discuss developmental theories, ask questions, and learn from each other. As a class, we will create a rubric that you will use to grade yourself and your peers. The instructor will provide you with resources including the course text, other developmental texts, powerpoint slides, a study guide, and a list of things you should be learning. This is your chance to learn the best way for you to learn and have a choice in that matter. If your group needs clarity on a specific topic or theory, that day we can have a discussion about it.

Use your textbook as a guide for what to learn. The objectives are located at the front of the chapters and it is what you are expected to learn and know.

Group 1: use chapters 1, 2, and 3

Group 2: use chapters 4, 9, 10, and 15

Appendix E:
Student Reflection Form

Student ID #:_____

Which method of instruction did you prefer over the course of the semester? (traditional or project-based learning)

What are some examples of your preference for that method? (Explain

Which method of instruction was most helpful when learning the material? Why?

Explain how the method you prefer may differ from the method that was most helpful?

Would you consider using project-based learning in your future classroom?

Appendix F:
Rubrics

Group 1
Student Rubrics

	20-16 Points	15-11 Points	10-6 Points	5-0 Points
Attendance	Teammate attends all classes during project and presentations	Teammate missed 1 class during project and presentations	Teammate missed 2 classes during project and presentations	Teammate missed 3 or more classes during project and presentations
	20-16 Points	15-11 Points	10-6 Points	5-0 Points
Teamwork	Teammate made a meaningful and more than equal contribution to the project and were easy to cooperate with. Went above and beyond their duties.	Teammate made a meaningful and equal contribution to the project and they were easy to cooperate with.	Teammate did some work regarding this project, but did not put full effort into working with the group.	Teammate did not work on this project, nor did they respond to the efforts and needs of their group

	20-16 Points	15-11 Points	10-6 Points	5-0 Points
Presentation used for both peers (20 points) and instructor (20 points)	Presentation is interesting and engaging, the presenters make clear points showing knowledge of content. They are prepared and professional. There is evidence of creativity and use of technology.	Presentation exhibits most of the following characteristics: interesting and engaging. Presenters lack some knowledge of content making the information confusing. There may be a lack of preparation, creativity, and/or use of technology.	Presentation is lacking many important features. There is a lot of confusion regarding the content. Presenters may not have prepared and there was a lack of creativity and/or technology	Presentation was not complete, did not include technology, and presenters did not prepare to answer their questions.
Comments:				

Instructor Rubrics for Project

	20-16 Points	15-11 Points	10-6 Points	5-0 Points
Project	Project demonstrates knowledge of the teacher preparation standard, uses creativity and technology	Project demonstrates a knowledge of the teacher standard, but is missing some information or lacks understanding	Project is lacking many important features. There is a lot of confusion regarding the content. Lack of creativity and/or technology	Project was not complete, did not include technology, and presenters did not prepare or show their

		and use of technology		understanding of the standard

Group 2
Student Rubrics

	10 Points	15-11 Points	10-6 Points	5-0 Points
Attendance	Teammate attends all classes during project and presentations	Teammate missed 1 class during project and presentations	Teammate missed 2 classes during project and presentations	Teammate missed 3 or more classes during project and presentations
	20-16 Points	15-11 Points	10-6 Points	5-0 Points
Teamwork	Teammate made a meaningful and more than equal contribution to the project and were easy to cooperate with. Went above and beyond their duties.	Teammate made a meaningful and equal contribution to the project and they were easy to cooperate with.	Teammate did some work regarding this project, but did not put full effort into working with the group.	Teammate did not work on this project, nor did they respond to the efforts and needs of their group

	20-16 Points	15-11 Points	10-6 Points	5-0 Points
Presentation used for both peers (20 points) and instructor (20 points)	Presentation is interesting and engaging, the presenters make clear points showing knowledge of content. They are prepared and professional. There is evidence of creativity and use of technology.	Presentation exhibits most of the following characteristics: interesting and engaging. Presenters lack some knowledge of content making the information confusing. There may be a lack of preparation, creativity, and/or use of technology.	Presentation is lacking many important features. There is a lot of confusion regarding the content. Presenters may not have prepared and there was a lack of creativity and/or technology	Presentation was not complete, did not include technology, and presenters did not prepare to answer their questions.
Comments:				

Instructor Rubrics for Project

	30-25 Points	24-20 Points	19-10 Points	9-0 Points
Project	Project demonstrates knowledge of the teacher preparation standard, uses	Project demonstrates a knowledge of the teacher standard, but is missing some information or lacks understanding and use of technology	Project is lacking many important features. There is a lot of confusion regarding the content. Lack of	Project was not complete, did not include technology, and presenters did not prepare or show their

	creativity and technology		creativity and/or technology	understanding of the standard