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AN EXPLORATION OF THE EFFECTS OF STUDENT-DIRECTED AND TEACHER-DIRECTED INQUIRY LEARNING ON CREATIVE PROBLEM SOLVING, CRITICAL THINKING, AND CIVIC RESPONSIBILITY

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AN EXPLORATION OF THE EFFECTS OF STUDENT-DIRECTED AND TEACHER-

DIRECTED INQUIRY LEARNING ON CREATIVE PROBLEM

SOLVING, CRITICAL THINKING, AND CIVIC RESPONSIBILITY

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AN EXPLORATION OF THE EFFECTS OF STUDENT-DIRECTED AND TEACHER-DIRECTED INQUIRY LEARNING ON CREATIVE PROBLEM SOLVING, CRITICAL THINKING, AND CIVIC RESPONSIBILITY

In this quasi-experimental study, a convenience sample was selected from eighth grade social studies students. There were 28 students who participated in the Student-Directed Inquiry group utilizing problem-based service learning, and 32 students in the Teacher-Directed Inquiry group.

This study was designed to measure the extent of the effects of problem-based service learning (PBSL) as a Student-Directed Inquiry approach as compared to a Teacher-Directed Inquiry not utilizing problem-based service learning, on eighth graders' motivation to apply creative problem solving and critical thinking, and as a measure of its impact on students' sense of civic responsibility.

Three research questions were examined. The first question was analyzed with a MANOVA to determine the effects of assignment to group on creative problem solving and critical thinking skills as measured by the CM3 II+. The five scales from the instrument included: Mental Focus, Learning Orientation, Creative Problem Solving, Cognitive Integrity, and Scholarly Rigor. The Teacher-Directed Inquiry group had significantly higher scores on two scales, Mental Focus ($M = 32.06$, $p = .001$), and Learning Orientation ($M = 34.44$, $p = .007$). The second research question was a posttest only design, and was analyzed with an ANOVA to determine the effects of assignment to group on students' civic responsibility. No significant differences were found. The third research question sought to determine the degree and manner in which group assignment, and motivation to use creative problem solving and critical thinking skills, predicts students' civic responsibility. A Multiple Regression was used to analyze these

results. It was determined that the set of independent variables were able to predict the

dependent variable ($F(6, 53) = 4.392$, $p < .001$).

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APPROVAL PAGE

School of Professional Studies
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Presented by

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DEDICATION

To the two men in my life who shaped me:

In memory of Harvey A. Goldstein M.D.

My father, who instilled the value of education in me and inspired me to set out upon this path.

He would have been so very proud of this achievement.

In honor of David M. Bell

My husband, who has unfalteringly supported me and our girls throughout this experience and

truly made this possible. His love and belief in me has carried me through the most challenging

times in this journey. He shares my joy in reaching this goal.

I am filled with eternal love and gratitude for these two incredible men. Thank you both.

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CHAPTER ONE:

INTRODUCTION AND OVERVIEW OF THE TOPIC

The paradigm of education is shifting from a local perspective to a more global context. In order to be competitive in a worldwide economy, students need to communicate effectively using advanced technology, think critically to analyze situations, and solve problems that require creative approaches. Moreover, they must also communicate cross-culturally, as they will most likely be collaborating with co-workers worldwide. These "survival skills" (Wagner, 2008, p. 14) are also termed as 21st Century skills (Bielefeldt, Paterson, & Swan, 2010).

In 2001, the No Child Left Behind Act (NCLB) was instituted to guarantee the academic success of all children in the United States. In effect, the act mandated statewide accountability systems. This mandate required schools to utilize the standardized tests that measure the basic skills of mathematics and literacy, as the primary tools for evaluating the educational system. To ensure that students were receiving adequate instruction in the assessed areas, school districts adapted curriculum that focused on direct instruction of these competencies (Furco, 2007). These educational decisions have not successfully improved students' academic growth (Furco, 2007). Teachers state that among a variety of issues leading to these results, that their own effectiveness was limited by student motivation (Bradford, 2005). Two purposes of inquiry instruction are to increase student motivation and provide opportunities to hone 21st Century skills such as critical thinking and creative problem-solving, while students master curriculum content (Bradford, 2005).

In 2000, The New York State Department of Education mandated the teaching of character education in schools in response to the rise in violence by students (New York

State United Teachers; NYSUT, 2007). The Safe Schools Against Violence in Education Act: Instruction in Civility, Citizenship and Character Education (Project SAVE), funded grants to schools to support the implementation of service learning initiatives and projects. These projects enabled students to problem solve while engaging in experiential, hands-on learning. Students utilized their citizenship skills to become contributing members of society, and made a difference in their local community and beyond (Bradley & Laird, 2009).

Problem-Based Service Learning (PBSL) is a Student-Directed Inquiry approach to instruction. Students engage in authentic, real-world problem solving that drives their learning while providing a service to a specific community. Students research and formulate solutions using a multitude of higher-order thinking skills. In this study, inquiry is examined at two different levels of teacher support to determine the effects of participation in a Student-Directed Inquiry approach utilizing a PBSL project and a Teacher-Directed Inquiry approach on students' motivation to use critical thinking and creative problem-solving skills, and the effects on citizenship values were explored.

Rationale

Today's students are expected to navigate a world that is very different from the one that currently exists. "We are currently preparing students for jobs that do not yet exist…using technologies that haven't been invented…in order to solve problems we don't know are problems yet" (Did You Know, 2010). For this reason, teachers are striving to develop instructional techniques that will prepare students for jobs of the future. Our society is rapidly changing, and our education system must respond. Students need to be able to critically evaluate the volume of information that they encounter. Skills such as creative problem-solving and critical thinking are paramount to students' future success (Wagner,

2008). Inquiry is one approach that enables students to develop their creative problem-solving skills and critical thinking abilities. These skills are especially useful when solving real-world, ill-structured problems. When problem-based learning is combined with service, problems can be addressed that occur at both a local and global level. Students can develop a sense of civic responsibility by contributing to society through these experiences that are authentic and meaningful (Scales, Blyth, Berkas, & Kielsmeier, 2000).

Service learning is an instructional context that involves students in real world, community-based service and integrates this service with curricular connections for both academic and community benefits (Campus Compact, 2010). Social studies curriculum is a natural forum for PBSL. Higher order thinking skills, including creative problem-solving and critical thinking, are relevant when teaching social studies. Using a PBSL approach to teach history and address current world issues is a way to increase students' global awareness. In addition, real world experiences including cross-cultural experiences, expand students' awareness and appreciation of differing values and help create global citizens. The National Council for the Social Studies is in accord with these ideas. "To support the application of these principles, educational systems must create a culture of inquiry and collaboration that enables all students and teachers to learn for their own sake and for the good of a culturally diverse democratic society in an interdependent world" (National Council for the Social Studies; NCSS, 2010, "Learning Occurs in a Global Context," para. 3).

Although service learning is inherently based on a problem, few studies have grounded service learning in a formal problem-based approach (Bielefeldt et al., 2010). Therefore, the rationale behind this study was to research problem-based service learning as a

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Student-Directed Inquiry approach to instruction and Teacher-Directed Inquiry, and measure the effectiveness of both models in improving students' critical thinking, creative problem-solving, and sense of civic responsibility.

Statement of the Problem

The role of teachers in a traditional educational environment has been that of "agents through which knowledge and skills are communicated and rules of conduct [are] enforced" (Dewey, 1938a, p. 18). In a traditional teacher-directed model, teachers are the primary instruments of instruction passing along information to the next generation. When teachers deliver instruction on specific knowledge and skills on which students will be tested, they are ensuring that students have been exposed to the requisite learning. The pressure of state testing often leads to educators teaching in this manner, which aligns with the format of the test (Wiggins & McTighe, 2007).

In a progressive model, using an inquiry approach, teachers are the facilitators of experiences. In fact, research supports that students excel academically when they are in control of their own learning (Liu, Divaharan, Peer, Quek, Wong, & Williams, n.d.; Muresan, 2009). The value of inquiry is being recognized as a viable strategy for instruction as more research supports inquiry methods as effective in raising test scores (Wheeler & Ryan, 1973). In recognition of the value of a rich curriculum that supports 21st Century skills, a paradigm shift is ensuing. There is a shift from a didactic approach where the teacher provides all the information, toward teachers instructing students on problem-solving processes, with the ultimate goal that curious, inquisitive students will seek out the problems that need to be solved. Some teachers are in the preliminary stages of incorporating inquiry strategies into their pedagogical practice. They are learning to support students in uncovering the

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curriculum by inviting thought provoking questions generated by students, rather than simply covering the material students need to learn for the test (Jeanpierre, 2006). Other teachers are realizing that they will soon need to shift to this approach to instruction as content area strategies across the curriculum are incorporating inquiry. By using the methods of inquiry, teachers gradually release control and responsibility of the learning from themselves to the students.

Multiple studies have been reported on inquiry. However, according to Herron (1971), there are four levels of inquiry, organized along a continuum, ranging from fully teacher-guided, to students' directing all of the learning. Herron's model was developed in relation to science teaching, however, as inquiry teaching is valued across curricular areas, this model can be adapted to fit as well. The levels range from Level 0, to Level 3. Level 0 is a confirmation of an answer to a question where the question, process, and answer are provided to students. Level 1 represents a structured inquiry, the teacher provides the question and process, and students determine the solution. Level 2 reflects a guided-inquiry, where a teacher provides the question or choice of questions, but students utilize their own processes to determine the solutions. At the open-inquiry stage, Level 3, students are generating their own inquiries, implementing their own procedures for gathering information and data, analyzing it, and interpreting this information into a solution. This study compares two of the four levels of inquiry, a structured inquiry and an open-inquiry.

Significance of the Research

This research project on inquiry and PBSL adds to the growing body of research on progressive educational approaches, 21st Century skill acquisition, and civic responsibility. It was the intent of this research to demonstrate the effects of inquiry and PBSL to teachers and

administrators in relation to students' motivation to use creative problem-solving and critical thinking skills for purposeful service. Moreover, this research explored the merit of Student-Directed Inquiry through a problem-based approach to learning that could support student learning in core academics as well as globally relevant skills. Ultimately, the significance of this research was to explore the effects of two inquiry approaches as instructional models that prepare students to work and function effectively in a global society.

Potential Benefits of the Research

As of President Obama's inauguration, a reemergence of service learning has been in the forefront due to his call to service initiative (Corporation for National and Community Service, 2011). President Obama believes that all students should participate in community service and to that end, set out a plan to integrate service into education. "The Obama-Biden plan sets a goal for all students to engage in service, with middle and high school students performing 50 hours of service each year, and college students performing 100 hours of service each year" (Obama & Biden, 2008, "Integrate Service into Education," para. 1). Some school districts have made service learning a strategic goal; others have adopted service learning as a magnet school philosophy such as The Barack and Michelle Obama Service learning Elementary School. This places a value on PBSL as a progressive approach. The main benefit of this research study was to examine the outcomes of participating in a Student-Directed Inquiry utilizing PBSL in comparison to a Teacher-Directed Inquiry in terms of students' critical thinking, creative problem-solving, and civic responsibility. A benefit for social studies teachers was that this research provided a curricular framework within which social studies teachers can teach students valuable higher order thinking skills and global competencies. Another focus of this study was to provide research on an

approach to instruction that does not require additional resources, which is an important consideration for school districts in current financially conservative times.

Definition of Key Terms

The following terms are relevant to this research study:

1. **21st Century Skills** are termed survival skills by Tony Wagner (2008). They include; "critical thinking and problem solving, collaboration across networks and leading by influence, agility and adaptability, initiative and entrepreneurialism, effective oral and written communication, accessing and analyzing information, and curiosity and imagination" (p. 67).

2. **Civic Efficacy** is the ability to engage in civic life (Miller, 2009).

3. **Civic Responsibility** means addressing social problems in an informed, committed, and positive manner (Constitutional Rights Foundation, 2010).

4. **Creative problem-solving** indicates a unique and original approach to solving problems (Giancarlo, 2010).

5. **Creative Problem-Solving Method (CPS)** is a systematic method of creative thinking and problem-solving involving both divergent and convergent thinking (Isaksen & Treffinger, 1985).

6. **Critical Thinking** is the use of cognitive thinking skills, "characterized as the process of purposeful, self-regulatory judgment" (Giancarlo, 2010, p. 4).

7. **Disposition** "refers to a person's internal motivation…attitudes, values, and inclinations" (Giancarlo, 2010, p. 4).

8. **Herron's Levels of Inquiry** is a conceptual framework for inquiry. It is grounded in scientific inquiry and includes "a four-point scale with which laboratory exercises can be compared in terms of their degree of openness" (1971, p. 200).

9. **Inquiry Learning** "is a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations" (National Research Council, 1996, p. 23).

10. **Motivation** refers to the physiological or psychological needs that drive behavior (Maslow, 1954).

11. **Problem-Based Service learning (PBSL)** "engages students in seeking solutions to real, community-based problems" (Western Carolina University, 2012, "Problem-Based Service Learning," para. 1)

12. **Problem-Based Learning (PBL)** is a "comprehensive approach to classroom teaching and learning that is designed to engage students in investigations of authentic problems" (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palinscar, 1991, p. 369). This is also sometimes referred to as project-based learning.

13. **Service learning** "incorporates community work into the curriculum, giving students real-world learning experiences that enhance their academic learning

while providing a tangible benefit for the community" (Campus Compact, 2010, "Initiatives: Service-Learning," para. 1).

14. **Student-Directed Inquiry** occurs when the teacher presents a topic and lets students develop their own questions and design their own investigations (Bonnstetter, 1988).

15. **Teacher-Directed Approach** "is a systematic method for presenting material in small steps, pausing to check for student understanding and eliciting active and successful participation from all students" (Rosenshine, 1986, p. 60).

16. **Type I** experiences are introductory experiences "designed to expose students to a wide variety of disciplines, topics, occupations, hobbies, persons, places, and events that would not ordinarily be covered in the regular curriculum" (Renzulli & Reis, 1997).

17. **Type II** activities include small group learning experiences designed to teach relevant processes and skills for creative problem solving and critical thinking, or necessary information related to the area of study (Renzulli & Reis, 1997).

18. **Type III** enrichment is a self-directed learning opportunity for individual or small group investigations of authentic problems. Students explore self-selected topics of interest (Renzulli & Reis, 1997).

<div align="center">**Methodology Overview**</div>

Setting and Subjects

The participants in this quasi-experimental study were eighth grade students. The Student-Directed Inquiry group was from a small, middle-class, suburban school district in the Northeast. There were 125 students in six classes in the eighth grade. All eighth grade

students were invited to participate in the study. Out of the entire grade, 44 students agreed to participate and 29 students completed the study. Both eighth grade social studies teachers delivered this treatment.

The students in the Teacher-Directed Inquiry comparison group were from a middle school with similar demographics according to the Strategic School Profile published by the Connecticut State Department of Education (2010). There were 215 students in the eighth grade at the second middle school. Five social studies classes with an average of 22 students per class were eligible to participate in the study. The total number of students in the final sample was $n = 32$. This was a sample of convenience.

Instrumentation

California Measure of Mental Motivation. The California Measure of Mental Motivation (CM3) (Giancarlo, 2010) was designed on the premise that critical thinking is linked to student engagement and motivation toward intellectual activities that involve reasoning. The level of the instrument used in this study was the California Measure of Mental Motivation, Level 1I+ (CM3). It was specifically designed for students in grades 6 - 12.

The purpose of the CM3 is to measure the following dispositional domains of critical thinking: Learning Orientation, Mental Focus, Cognitive Integrity, Creative Problem Solving, and Scholarly Rigor. The CM3 results were reported as scale scores of up to 50 points per scale. Higher scores indicate a stronger disposition toward the attribute.

Reliability and validity. The internal consistency of the CM3 was evaluated with Cronbach's alpha coefficients ranging from .53 to .83 for the various scales. Validity was documented by correlating the CM3 with an established tool utilized for measuring student

motivation. The four factors were measured were Mental Focus, Cognitive Integrity, Learning Orientation, and Creative Problem-Solving as these appear on all levels of the CM3. Scholarly Rigor was added to the CM3 level II+ in 2006. There was a positive correlation for all four scales with mastery goals, self-efficacy, and self-regulation at the $p <$ .01 level. Correlating the five scales with students' standardized test scores and GPA tested predictive validity. There were moderate relationships between students' reported inclination towards creative problem-solving and the math subtest of the SAT9 ($r = .43, p < .001$) and GPA was significantly related to the Mental Focus scale ($r = .44, p < .01$) (Giancarlo, Blohm, & Urdan, 2004).

The Civic Responsibility Survey. The Civic Responsibility Survey (CRS) (Furco, Muller, & Ammon, 1998) level two, was designed specifically to measure civic attitudes in middle school students engaged in service learning. It measures three constructs: connection to community, civic efficacy, and civic awareness. To score the CRS, the items are totaled, and then 10 points are subtracted, to create the final overall score. Scoring could also be calculated by subscale, using the means. Higher scores reflect greater civic responsibility.

Reliability and validity. The CRS is a reliable measure and the authors report reliability for the total score at .84. Each construct reports reliability ranging from .63 to .77. Construct validity was established by testing gifted students at the high school level who applied for a civics program and gifted students who applied for an academic program. Students who applied for the civics program scored higher on the CRS. Thereby establishing that the CRS in fact measures civic responsibility as it was developed on the theory that civic responsibility leads to civic engagement.

Research Questions

The research addressed the following questions:

1. Is there a significant difference in students' motivation to use creative problem-solving and critical thinking skills between eighth grade students who were engaged in a Student-Directed Inquiry using a PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in a social studies class?

2. Is there a significant difference in students' sense of civic responsibility between eighth grade students who were engaged in a Student-Directed Inquiry using a PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in a social studies class?

3. To what degree and in what manner do group membership in a Student-Directed Inquiry utilizing a PBSL or a Teacher-Directed Inquiry, and students' motivation to use creative problem-solving and critical thinking skills, predict civic responsibility?

Design and Analysis

In this quasi-experimental study, a pre-posttest design was employed for the first research question. The CM3 was analyzed quantitatively to measure student creativity and critical thinking using a Multivariate Analysis of Variance (MANOVA).

For research question two, quantitative data were collected and analyzed using a posttest only design. This design was selected due to the reactivity of the instrument. The posttest results examined whether or not there was a difference between the Student-Directed Inquiry group and the Teacher-Directed Inquiry group. An Analysis of Variance (ANOVA) was used to analyze the results of the CRS as a total score.

For research question three, a correlational design employing a multiple regression analysis was used to predict civic responsibility through the set of variables including group membership, critical thinking, and creative thinking.

Data Collection Procedure and Timeline

Prior Activity. Prior to the beginning of this study, in the fall of 2010, students in the Student-Directed Inquiry group were engaged in the preliminary selection processes of an area of study for their service learning project. They were introduced to the countries of Haiti and Tanzania, and selected one country as an area of focus for their service learning project. The students in the Teacher-Directed inquiry group engaged in traditional social studies instruction.

Permission. Permission was granted to the researcher by the districts and schools in December of 2010. In January 2010, permissions were issued to all eighth grade students. Due to multiple snow days, the permissions were ultimately collected in late February.

Procedures and Professional Development. The study commenced upon receipt of the signed student permission slips. In the Student-Directed Inquiry group, two social studies teachers and 14 advisors delivered the treatment. Advisory groups for eighth grade students occurred on a bi-weekly basis and were led by voluntary advisors. All eighth graders participated in 14 advisory groups of approximately 9 students in each. Advisory meetings were developed to address social acceptance and awareness, team building, and character education in the school. In the year this study took place, service learning became the focus in advisory. The researcher delivered professional development during two one-hour professional development sessions with advisors and two additional training sessions with social studies teachers. A teachers' manual and student booklet was created, reviewed, and

disseminated for use during advisory. Professional development for the advisors at the Student-Directed Inquiry site included training in the CPS process, brainstorming techniques, the language of creativity, instruction and review of the teachers' manual, and the definition of service learning. Two additional sessions of professional development were provided for the social studies teachers, which included further training in creativity and critical thinking processes and unit development incorporating the Creative Problem Solving (CPS) method. The social studies teachers also facilitated advisory groups. Frequent contact was made with teachers and advisors via email and in-person check-ins. This allowed for clarification, troubleshooting, and reminders.

The social studies teacher in the Teacher-Directed Inquiry group developed a multidisciplinary unit of study for the Capstone project utilizing inquiry-based teaching methods. This Capstone project was based on the research article by Bell (2010) regarding project-based learning as an instructional strategy to develop 21st century skills. No additional training took place.

Pretest. All study participants were given a pretest for the CM3. Those in the Student-Directed Inquiry group completed the pretest prior to learning about the CPS approach in early March 2011. The Teacher-Directed Inquiry group began their Capstone project in February, but due to scheduling issues had already completed the pretest in November. The pretest data were used to establish the similarities between the Student-Directed Inquiry group and the Teacher-Directed Inquiry group.

Treatment. The Student-Directed Inquiry group's curriculum model was based on Renzulli's Enrichment Triad Model (Renzulli & Reis, 1997). Students were involved in introductory exploratory activities called Type I experiences prior to the start of the study.

Throughout the year, students met in advisory groups to learn about Tanzania, the focus of the service learning. Upon the study commencing, students were involved in mini-courses called Type II experiences. For six weeks, students in the Student-Directed Inquiry group received a problem-based approach to instruction, which included the direct instruction for the skills they needed to solve a problem, including explicit training in a creative problem solving technique, research skills, and the use of technology. This was done in social studies classes over the course of two units of study. Type III experiences were the open-inquiry investigations that the students conducted as part of the service project. Students directed their own inquiry during the advisory period and solved the problems related to the service project. Participants completed a service project to benefit students in Tanzania. They also kept a reflection journal of the process, which was monitored to ensure that the service learning was being implemented with integrity.

Beginning in September, the students in the Teacher-Directed Inquiry group participated in traditional social studies instruction. After the commencement of the study, students in the Teacher-Directed Inquiry group engaged in social studies inquiries guided by the teacher. The students were presented with questions regarding current events and given resources to seek out information and form positions on issues. Students also engaged in a long-term Capstone inquiry project where they worked together in groups to identify relevant issues for the 21st Century and conducted research. The teacher guided the students through the inquiry process of question generating and evaluation of sources.

Posttest. Upon completion of the service learning project in May, all students in the Student-Directed Inquiry group completed a posttest of the CM3 and CRS. In April, the students in the Teacher-Directed Inquiry group responded to the posttest of the CM3. The

district personnel selected this earlier date based on student availability. The CRS was

administered in May at the completion of the Capstone project. Data were analyzed and

reported at the completion of the study.

CHAPTER TWO:

REVIEW OF THE LITERATURE

Chapter Overview

The review of the literature is divided into five sections. The first section relates the theories of John Dewey (1938a, 1938b) to problem-based learning and service learning. It also focuses on Bandura's (2007) theory of self-efficacy in relation to civics. The second section outlines the constructs of creativity and critical thinking. The third section includes research on inquiry learning. It also explores problem-based learning as a promising open-inquiry method for teaching critical thinking and creative problem-solving. The fourth section highlights the service learning approach as a conduit for building students' sense of civic responsibility. The final section provides a discussion of research on self-efficacy for civic responsibility.

Theoretical Constructs

John Dewey

In order to tap the intellectual portion of learning, information must be more than acquired; it must be applied (Dewey, 1938a). Inquiry learning, whether teacher guided or student directed, enables students to synthesize static knowledge by solving problems. Inquiry as viewed through an educational lens is a process that is situated beyond the classroom, in real or authentic contexts, where students must ask questions and generate viable solutions, using the tools of scientists, historians, mathematicians, and so forth. Inquiry is a critical process and is action-based, social, and reflective (Shore, Aulls, & Delcourt, 2008). The theoretical underpinnings of this study lie in John Dewey's (1938b) "pattern of inquiry" (p. 101). He stated that, "the first result of evocation of inquiry is that

the situation is taken, adjudged, to be problematic. To see that a situation requires inquiry is the initial step in inquiry" (p. 107). This speaks to the necessary integration of problem finding in the inquiry process. Dewey (1938b) further explained that as students explore the problems and questions generated through their inquiries, they utilize multiple skills such as critical thinking when gathering pertinent information, and creative thinking when brainstorming solutions. Dewey believed that creative thoughts enter our consciousness and often begin as small seeds of ideas. When novel ideas are left in the mind, these ideas may germinate, and lead directly to actions or solutions. Within the Creative Problem-Solving (CPS) Method by Isaksen and Treffinger (1985), students use critical thinking to analyze possible solutions to problems and identify the most viable solutions. Dewey (1938b) further supported the value of critical analysis in the CPS process by stating, "One fundamentally important phase of the transformation of the situation which constitutes inquiry is central in the treatment of judgment and its functions" (p. 118). Dewey believed that knowledge was obtained through finding satisfactory solutions to inquiries.

John Dewey (1938a) valued the exploratory experience as a primary source of education. He was a proponent of the universal influence of life experience on a students' education. Dewey advocated that the role of the teacher is to provide quality experiences for students, which are not only enjoyable at the moment, but encourage inquiry and future investigative learning experiences. Service learning is grounded in the concept that learning should connect curriculum content to rich experiences that are relevant, authentic, and meaningful to students. Service learning sets a purpose for student learning. It is a process in which an idea is fully explored, then acted upon. This is concurrent with Dewey's philosophy. Moreover, because service learning has a civic component, Dewey's philosophy

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of incorporating social and moral ethics is consistent with the goals of service learning as he espoused active participation in civic life (Conrad & Hedin, 1991).

Albert Bandura

"Self-efficacy forms the foundation of the civic-efficacy construct" (Miller, 2009, p. 10). The construct of self-efficacy is founded on Albert Bandura's social cognitive theory (2007). The underpinnings of this theory are that an individual's belief in his or her ability to perform a task is directly related to his or her actual ability to perform a task. Albert Bandura (2007) affirmed that in order to manage situations and outcomes, people must believe in their own ability to plan and execute a course of action that will result in a desired outcome. This belief in ones' abilities he coined as the term, perceived self-efficacy. Self-efficacy shapes the way people feel about themselves, their motivation, and in turn the actions they take.

Self-efficacy can be developed in a variety of ways. One way self-efficacy is acquired is through successful experiences. To achieve a robust sense of self-efficacy, experiencing a degree of failure and then finding effective ways to overcome obstacles is necessary. This indicates that creative problem solving in inquiry-based learning can contribute to self-efficacy as students often must flow in and out of the various phases of critical and creative processes until they garner successful solutions. Working through the struggle is essential to gaining a true sense of accomplishment. A second way of obtaining a sense of self-efficacy is by observing peer models who obtain success. When a person perceives someone as similar to himself or herself and that person is successful in a particular task, the individual believes he or she can also be successful at that task. Self-efficacy is also developed by social persuasion, which is the verbal encouragement that one has the ability to achieve a goal or perform a task. A teacher who facilitates an inquiry learning experience

can provide this support, but it must be realistic and lead to students' success in order to build self-efficacy. Finally, the fourth method of developing a students' self-efficacy is in managing the emotional response to situations. Students can react in a positive manner and be energized, or they can feel stress, thus negatively modifying their own feelings of self-efficacy, when encountering unfamiliar or difficult tasks. These four types of experiences contribute to a person's belief in his or her own ability to perform.

Bandura (1997) emphasized the importance of self-efficacy in terms of civic involvement. When students engage in successful civic experiences, their sense of civic efficacy rises. Those who feel that they can effect change become politically active and thereby have some command over their lives. Our society depends on individuals engaging in civic behavior as civic cynicism can lead to political distrust and unrest. Service learning is an educational approach that is framed in inquiry. Students are presented with a socially relevant problematic situation. Students set goals and outcomes, and this sustains their motivation to face challenges that they need to overcome. Overcoming obstacles successfully promotes a high degree of self-efficacy as they are able to contribute to society, which in turn reinforces their sense of civic efficacy.

Constructs

Creativity

Creativity is a term that can be described operationally as elaboration, fluidity, flexibility, and originality of ideas (Torrance, 1988). E. Paul Torrance described these behaviors as creative, divergent thinking (1988). He also described creativity as identifying gaps or challenges and generating meaningful new solutions. These solutions include many

diverse options that are novel or unusual. Creativity includes seeking out non-traditional and innovative ideas.

Elaboration is the extension or enlarging of an existing idea (Treffinger, Isaksen, & Stead-Dorval, 2005). One may add details to expand a solution that already exists. Fluid thinking includes the generation of numerous ideas. Flexibility is an aspect of creativity that denotes the ability to think about an issue from multiple perspectives, leading to an original or unique solution.

Creative Thinking

Creative thinking is the divergent thinking process wherein students will put aside the parameters of critical analysis and judgment and open up to wonderment and supposition. This widening of the view enables students to take various perspectives, combine unlike thoughts, and delve into the far reaches of all the possibilities they can imagine. Creative Problem-Solving (CPS) uses creative and critical thinking to enable students to be innovative.

Critical Thinking

Critical thinking includes the convergent processes that enable a student to focus, analyze, and evaluate ideas for viability. When thinking critically, students employ their judgment to reflect on ideas, then carefully assess and refine solutions until they are deemed useful, appropriate, and ultimately effective (Treffinger, et al., 2005).

Self-Efficacy for Civic Responsibility

The literature supports the value of service learning across populations in terms of civic growth as measured both qualitatively and quantitatively. Christina Miller (2009) conducted her dissertation research exploring service learning and civic efficacy among

youth with disabilities. According to Miller (2009) "civic-efficacy refers to an individual's belief in his or her ability to engage in civic life" (p. 10). Miller linked the concept of civic efficacy to service learning among disabled high school students from high school programs in rural, suburban, and urban areas in Florida, specializing in preparing disabled students for careers in technology. Using a mixed method approach, Miller's sample of high school students ($n = 156$) with disabilities age $14 - 22$ were involved in a service learning program called Project Impact. The comparison group ($n = 63$) was not involved with Project Impact. The researcher developed, validated, and used The Civic Efficacy Scale to collect data and found that although there was a higher overall civic efficacy for the treatment group, the only significant differences were in community service self-efficacy scores ($M = 4.25$, $SD = .656$), ($t = 2.344$, $df = 175$, $p = .02$) among the students who participated in service learning as compared to the students who did not participate in service learning. The qualitative data were collected from interviews, documents, observations and focus groups with participants and staff from Project Impact. The qualitative investigation sought out information regarding the experiences of disabled students in service learning. Students reported that they found the service learning project fun and wanted to do more projects. Students also reported that participation in service learning helped them grow and develop maturity, supported their preparation for the future and life after school, and helped their community. Miller also found that the projects, although designed according to service learning best practices, were not always implemented with integrity. There was variation in the implementation of the service learning across sites. For example, some students were unable to perform acts of service due to the lack of jobs as compared to the number of volunteers, disorganization

leading to inadequate materials to perform the service, or laws prohibiting the alteration of public spaces. A weak correlation between service and curriculum was also noted.

At the middle school level, community service self-efficacy was studied utilizing qualitative and quantitative methods (Dauberman, nd). The students *(n = 53)* in this study attended a two-week camp at the Youth Community Service 2004 Summer of Service Program. The students were in two separate camp sessions with 27 campers in the second session and 25 campers in the third session. The program focused on service learning and campers spent a majority of their time learning about social issues, performing service in the community, and reflecting and evaluating their actions. The other portion of the camp was spent team building and engaging in celebratory activities. Students were given choices for their area of service including childcare and education, environmental issues, hunger and homelessness, and healthcare.

Pre and posttests were administered to students. They were given a 28-question survey developed specifically for middle school students to measure community service self-efficacy. Interviews were also conducted at the beginning and end of the camp and focus groups took place on the last day of camp.

Demographics of the students indicated that students spanned across grades six through nine and all ethnicities. The *t*-tests showed significant gains in community service self-efficacy during the two-week camp for campers who attended both sessions. The second session group $(M=145, SD = 16.56, df = 26, p < .001)$ had a small effect size $(d = .47)$, and the third session group $(M=145, SD = 16.56, df = 25, p < .002)$ had a medium $(d = .59)$ effect size. Focus group results yielded information related to what students believed they were able to do in their community. Forty-six percent of results were coded as vague, while 54%

were coded as articulate. Interview results were coded for changes in results to more elaborate and practical responses regarding their ability to serve in their communities. Post-camp, 65% of the campers had more elaborate responses.

Results, both qualitative and quantitative, demonstrated increased feelings of community service self-efficacy after the two-week camp. This study suggested that participating in authentic service experiences in the community were necessary to develop community service self-efficacy (Dauberman, nd).

In the literature reviewed, evidence points to problem-based learning as an effective approach to hone creative problem-solving and critical thinking skills (Alacapinar, 2008; Boaler, 1998). Research also supported service learning as a viable method for increasing students' sense of civic responsibility (Dauberman, nd; Lee, et al., 2007; Miller, 2009). Although few studies directly connected problem-based learning and service learning, ample evidence exists that the two share common underpinnings in problem solving and can be merged to create problem-based service learning (Conrad & Hedin, 1991).

Instructional Methods

Within this study, there are multiple instructional methods that are melded to create a 21st century educational experience for students. Inquiry, open or guided, is an educational framework through which the instruction is presented. Inquiry includes a degree of ambiguity to allow students to wrestle with concepts and generate excitement. This necessitates adequate teacher training in this methodology for effective management. Teachers must support students by scaffolding their instruction, teaching them the skills necessary for successfully moving toward a solution through information gathering, knowledge building, synthesis of information, and critical analysis (Aulls, 2008).

Inquiry inherently is problem-based as students are asking questions to guide their learning. Problem-based learning is a sub-set of inquiry wherein students are presented with, or discover a relevant authentic problem and this leads to a deep level of investigation to construct knowledge and analysis to find solutions utilizing the Creative Problem Solving (CPS) method. In this case, problem-based learning is an open-inquiry or student-directed implementation of inquiry.

Service learning is the context for which the open-inquiry is presented in this study. Service learning is an educational approach that combines educational objectives and community service. The ultimate goals are to benefit the community, build civic-minded students, and enrich the curriculum with service. Problem-based service learning (PBSL) combines these two approaches.

Inquiry as a Framework for Instruction

Inquiry in social studies instruction. "Inquiry is an active learning process in which students answer research questions through data analysis" (Bell, Smetana, & Binns, 2005, p. 30). While primarily utilized as an approach to science instruction, inquiry has also been recognized for its value across content areas, including the social sciences (Shore, Aulls, & Delcourt, 2008). Students are able to construct meaning from historical events through inquiries and consideration of information utilizing primary source information from multiple perspectives (Foster & Padgett, 1999). The National Council for the Social Studies (1994) links historical inquiry to the goals of citizenship education by helping "young people make informed and reasoned decisions for the public good as citizens of a culturally diverse, democratic society in an interdependent world" (para. 3). The following studies validate the

effectiveness of inquiry as a teaching framework for instruction in terms of academic achievement.

It is important to establish inquiry as a viable method of instruction for equal or superior academic achievement outcomes as compared to traditional methods. Although inquiry is primarily studied in the sciences, there are several studies that highlight the effectiveness of inquiry in social studies. A researcher in India investigated the effectiveness of traditional teaching methods using the Suchman Inquiry Training Model (Suchman, 1962) on the development of process skills in geography (Kaur, 1998). Suchman's Inquiry Training Model was based on his notion that all knowledge was dynamic and evolving. He believed that hypotheses and theories were constantly being tested and revised in response to inquiries and this constituted learning. Process skills include the ability to collect data, analyze it, and apply the findings in a logical method. This quasi-experimental, pre/post test design study randomly assigned eight sections *(n = 400)* of female ninth grade students to classes in which teachers taught geography lessons using either traditional teaching methods, or the inquiry training model. The pretest indicated no significant differences ($t = 0.650$) in intelligence, or prior knowledge of geography between groups, and there was no significant difference ($t = 0.44$) in socio-economic status between groups. Students in both the treatment and control groups received 17 geography lessons of 35 minutes each. Criterion-based geography posttests were administered after the treatment period ended. The posttests were found to have a reliable alpha level of 0.82 by the test-retest method, and had content validity as confirmed by a panel of geography teachers. The results indicated that there was a statistically significant difference in the development of process skills as the students

receiving the inquiry teaching were significantly higher ($t = 8.35$, $p < .01$) in process skills in geography.

Another Indian study by Dubey, cited in Vanaja (1999), found similar results in terms of effectiveness of learning outcomes being significantly greater for students who were taught using inquiry methods than by those using traditional instructional approaches. Dubey's study also explored creativity as a secondary investigation and found higher mean scores in verbal creativity using the Torrance Test of Creative Thinking for students utilizing inquiry methods as compared to those students being taught with traditional teaching methods, but they were not statistically significant.

Wheeler and Ryan (1973) conducted an experimental study with 88 fifth and sixth graders who were randomly assigned to one of three groups. One group was the control group *(n = 30)* who learned social studies through traditional methods. The other two groups *(n = 58)* were the treatment groups and they utilized inquiry strategies, one in a competitive structure, the other cooperative in nature. For 18 lessons, students learned the same content. At the end of the study an achievement post-test was administered to all three groups. Three attitude surveys were administered twice to the inquiry groups; after nine lessons, and at the culmination of the study. They measured students' perceptions towards competitive and cooperative events, attitudes toward social studies, and attitudes toward cooperation.

The results indicated that of the students in the inquiry groups, students in the cooperative subgroup held a more positive attitude toward social studies than the competitive subgroup ($t = 2.23$, *df = 28, $p < .05$*). Results of the achievement test also indicated that students who received the treatment performed significantly better on their achievement post-tests *(F = 7.52, df = 2/81, $p < .001$*) than the control group who received traditional teaching.

The aforementioned research studies indicated that inquiry was an effective method of instruction for social studies as compared to traditional teaching, particularly in terms of student achievement, and the development of process skills. This information is beneficial to this researcher as it provides a foundation to move forward and examine inquiry in social studies as a viable method in a more specific and detailed manner.

Inquiry in science instruction. In the science literature, inquiry has been analyzed regarding several levels of inquiry from completely teacher-directed to thoroughly student-directed. The four levels include confirmation, structured inquiry, guided-inquiry, and open-inquiry (Herron, 1971). Confirmation occurs when students verify an idea by performing a procedure that is teacher prescribed where the results are known in advance, and thereby confirmed through the exercise or experiment. In a structured inquiry, the teacher predetermines the procedure, but the solution is unknown to the student. Guided-inquiry occurs when students are able to use their own procedures to solve a teacher-given question or problem. An open-inquiry allows students to design their own questions, develop procedures, and discover the solutions, with the teacher overseeing the process (Herron, 1971). See Table 1 for a further explanation of the levels of inquiry.

Table 1

Four levels of inquiry

Essential Feature	Level 0 Confirmation	Level 1 Structured Inquiry	Level 2 Guided-inquiry	Level 3 Open-inquiry
Learner engages in scientifically oriented questions	Teacher provides question	Teacher provides question	Teacher provides question or choice of questions	Student generates question
Learner utilizes procedures for collecting data	Teacher provides procedures	Teacher provides procedures	Student generates procedures	Student generates procedures
Learner formulates explanations or solutions from the data	Teacher generates solution	Student generates solution	Student generates solution	Student generates solution

(Adapted from Herron, 1971)

Scaffolding is addressed in the literature as a key component of inquiry learning (Foster & Padgett, 1999; Hmelo-Silver, Duncan, & Chinn, 2007). Scaffolding occurs when a task is beyond the ability of the learner; the teacher supports the instruction by facilitating portions of the task so that the learner can achieve a goal (Wood, Bruner, & Ross, 1976). Often, inquiry learning is perceived incorrectly as a minimally guided approach. However, the teacher is integral to the process, anticipating the students' learning needs, and providing scaffolded instruction to support student success. It is often the degree of independence that is the variable in students' success. Herron's (1971) four levels of inquiry categorize the amount of teacher support or scaffolding a teacher gives during inquiry-based instruction.

Related research on inquiry at four levels. Inquiry has been studied as an overarching framework. However, little research exists on the topic of comparing inquiries on a continuum from most to least structured. Herron (1971) identified four levels of inquiry. Others have also modified this work to indicate sub-levels of teacher directedness (Hegarty-Hazel, 1986; Staer, Goodrum, & Hacking, 1998). The research in this section includes studies that discriminate between guided- and open-inquiry. This research is relevant as the present study examines inquiry at both the open-inquiry level and the guided-inquiry level.

This researcher performed an exhaustive search in EBSCO Combined Databases utilizing terms including inquiry, open-inquiry, guided-inquiry, Teacher-Directed Inquiry, and Student-Directed Inquiry. When these terms were combined with social studies, no results were garnered. The researcher did not narrow the search to the middle school level. The researcher then combined these terms with science, and nine articles were retrieved. Of the nine articles, seven were informational articles for teachers about how to implement

inquiry, or research studies on teacher perceptions of inquiry in the science classroom. Two research studies (Chatterjee, Williamson, & McCann, 2009; Sadeh & Zion, 2009) compared open-inquiry to guided-inquiry. The following studies include articles that discriminated between different levels of inquiry and compared the effectiveness of differing levels of inquiry, including no inquiry, in the sciences.

Students have a variety of needs that can be addressed at the various levels of inquiry (Tuan, Chin, Tsai, & Cheng, 2005). Tuan et al. (2005) conducted a study on the effectiveness of inquiry instruction on the motivation of different learning styles of 8th grade students. Tuan et al. (2005) utilized guided-inquiry as they asserted it met students' needs for authority, while addressing the concerns of Taiwanese science teachers which included; meeting curriculum standards in large classes of approximately 35 students per class, and providing content knowledge to students while improving student performance. The researchers conducted this study utilizing both qualitative and quantitative methods to investigate motivation as a holistic concept as they felt that:

> Students have to value the science activity in order to decide whether they want to participate in it, they need to have strong self-efficacy in order to have long persistence in the science activities, then they have to use learning strategies to integrate new information with their previous knowledge in order to have cognitive engagement. (p. 547)

In this guided-inquiry study, seven classes of 8th graders *(n = 254)* from seven different junior high schools were selected to participate in the treatment group. Another seven classes from each of the seven different junior high schools were selected as the control group *(n = 232)*. The control group was taught using traditional science teaching

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methods. The researchers compared students' motivation after the treatment group experienced inquiry-based teaching. The researchers also explored the students' learning styles in relation to their motivation.

Students in the treatment group experienced 10 weeks of guided inquiry-based instruction. They also completed a learning styles questionnaire prior to the treatment and 40 students with different learning styles were selected for post-treatment interviews to supplement the qualitative findings. All participants took pre and posttests of the Students Motivation Toward Science Learning questionnaire (SMTSL) (Tuan, Chinn, & Shieh, 2005). The SMTSL is a 5-point Likert-type scale consisting of self-efficacy, science learning value, active learning strategies, performance goal, achievement goal, and learning environment stimulation. The reliability for "the entire scale is .89; for the scales ranged from .70 to .89" (Tuan et al., 2005, p. 549).

The researchers utilized a t-test to analyze the data of pre and posttest scores on the SMTSL between the two levels of the independent variables of those who received guided-inquiry and those who were taught using traditional science methods. Students' SMTSL scores were further examined with a multivariate analysis of variance (MANOVA) to compare the effects of inquiry teaching on four learning styles. The guided-inquiry group showed a significant increase in their overall motivation ($t = 3.80$, $p < .0001$). However, no significant differences were found in students' motivation between the four learning styles after inquiry teaching. The researchers conducted interviews with students from the four learning styles. The researchers learned that while students had varied reasons for participation in inquiry-based science instruction based on learning style, all reported that

inquiry increased their motivation towards learning science. These qualitative findings supported the quantitative findings.

In a Finnish study, Sormunen (2008) explored fifth graders' problem solving abilities in open-ended inquiry. Utilizing qualitative methods, the researcher collected data over three weekly sessions of 60–70 minutes each, of a voluntary science club ($n = 4$). Students were video taped during the sessions and interviews followed where they reviewed the problem solving procedures utilized by the students. The problem solving process included five phases: orientation, planning, execution, evaluation, and communication (Sormunen, 2008).

Sormunen (2008) contended that students' motivation to solve problems was tied to facing a meaningful problem in a unique and authentic situation. Students should have had the open structure that allowed them to plan, design, and conduct a purposeful study. He cautioned that students could get frustrated when their skill level is not commensurate with the task, and students must be supported by the teacher with appropriate scaffolding so that they are able to solve their problem with minimal frustration. This investigation focused on what the students' problem solving processes were like in an open-ended inquiry. Students were presented with a scientific problem and given the charge of explaining the phenomena, planning, and solving the problem. Students worked in pairs to evaluate their data and presented their solutions to their peers.

Sormunen (2008) found that students had little experience with solving problems and needed guidance to construct a solution. Their limited declarative, strategic, and procedural knowledge lead to low success in solving the problems. The researcher concluded that teachers' knowledge of the inquiry process was critical to student success as

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they could then facilitate the learning. Students' instructional needs could be met with inquiry activities when appropriate scaffolding was provided throughout the inquiry process from planning, to implementation, to data analysis and drawing conclusions. This research suggested a guided approach to inquiry, concluding that more structured learning processes led to greater student success. When students were not supported, they reached high frustration levels, which led to low levels of successful problem solving. Motivation and interest were also found to be significant factors for successful problem solving.

It has been documented that student frustration is a factor to consider during inquiry teaching (Fishback & Daniel, 2011; Sormunen, 2008). When students get frustrated, they do not engage as well, nor feel as positive towards the subject matter (Fishback & Daniel, 2011). Motivation to learn, or apply creative and critical thinking skills, is also affected by feelings of frustration.

This researcher was interested in learning more about student motivation to use critical and creative thinking skills. The aforementioned study contributed to the design of her study wherein the students demonstrated a need for training in the CPS process. This information guided this researcher to design the treatment of the Student-Directed Inquiry group so that students engaged in social studies units that provided instruction on the creative problem solving processes. The intent was to give students the requisite skills and experience with the processes they required for successful problem solving in the open-inquiry service learning project. This successful enactive experience enabled students to have increased self-efficacy with the CPS process prior to performing an open-inquiry and thereby alleviating frustration. The Teacher-Directed Inquiry group had structured guidance throughout the Capstone project process in order to diminish frustration. Tuan, et al. (2005)

reported that the guided-inquiry approach resulted in greater motivation as compared to those students who had not received inquiry instruction.

Sadeh and Zion (2009) conducted a study in Israel comparing open to guided-inquiry and its effects on the development of dynamic inquiry performances. Dynamic inquiry performances are student responses to changes during an inquiry including critical thinking and analysis skills as data emerges, as well as responses in adjusting inquiry procedures based on the data. Sadeh and Zion sought to investigate if the type of inquiry had an effect on the development of these critical thinking skills.

Sadeh and Zion considered prior research as a rationale for selecting open and guided-inquiry approaches when designing their study. One of the arguments that inspired Sadeh and Zion's research study was that open-inquiry allows students to see that science is not static and that there is much for students to learn from trial and error and grappling with the unknown (Berg, Bergendahl, Lundberg, and Tibell (2003). Other research that Sadeh and Zion considered when designing their study was that guided-inquiry can maximize the volume of learning as time is utilized more effectively. Guided-inquiry can also lead to students experiencing lower levels of frustration, which is beneficial (Trautmann, MaKinster, & Avery, 2004).

In this two-year longitudinal study, 50 high school biology majors from four high schools participated. There were 18 females and 7 males engaged in open-inquiry, and 19 females and 6 males engaged in guided-inquiry. The students were followed through their 11th and 12th grade biology coursework. Students were taught using either guided-inquiry or open-inquiry methods throughout the two years. Students had similar socio-cultural backgrounds, socio-economic status, and academic achievement. Four teachers were

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selected from a pool of 18 to provide the instruction according to their assigned method. Teachers were deemed equivalent in years of teaching experience, experience in administering biology exams, level of education, regard their colleagues had for their expertise, participation in professional development, and attitude toward biology.

Data were collected throughout the study and included log books, interviews, papers, and reflections. Data were categorized as low, medium, or high levels for each of the following four criteria: changes occurring during inquiry, learning as a process, procedural understanding, and affective points of view. They were then quantified and analyzed with a MANOVA.

Qualitative results indicated that the dynamic inquiry skill levels were generally higher in the open-ended inquiry groups, as demonstrated by richer and more precise examples of the scientific inquiry process and the nature of science as compared to the guided-inquiry group. Open-inquiry group students designed their own process rather than being given a prescribed process. Students observed the difficulties in obtaining valid results and continually revised their experimental processes, which led to greater procedural understanding. Both groups exhibited high levels in the following areas: "learning as a process, affective points of view, and procedural understandings" (p. 1143). However, students in the open-ended inquiry group also reported high levels in the area of "changes during inquiry" (p. 1143), meaning the student experienced unexpected events during the implementation of the inquiry requiring rethinking the process that he or she utilized or garnered surprising results. The students in the guided-inquiry group did not report high levels of "changes during inquiry" (p. 1143). This references the flexibility and the

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adaptability of open-inquiry students to adjust and respond to changing conditions during experiments.

Quantitative results indicated a statistically significant difference between the two groups for the dynamic inquiry skills total score ($F(4, 48) = 19.95$, $p < .001$) with the open-inquiry group outperforming the guided-inquiry group. In addition, there was significance found in two areas of dynamic inquiry: changes occurring during inquiry ($F(1, 48) = 22.56$, $p < .001$) and procedural understanding ($F(1, 48) = 13.65$, $p < .001$).

The conclusions that can be drawn from Sadeh and Zion's study are that when students engaged in open-ended inquiry, they recognized that science was not pre-determined and that response to changes while conducting experiments were critical in science. Moreover, because students must grappled with the unknown, students recognized the procedural challenges scientists face in obtaining valid and reliable data. Students also developed a greater understanding of the scientific process (Sadeh & Zion, 2009).

This study reinforces the value of learning procedures for inquiry as students who internalized this method, could possibly later utilize these skills independently to conduct their own inquires. Students who engage in open-inquiry are faced with challenges as they navigate through the process. They must demonstrate flexibility in their thinking which is a form of creativity and they must utilize their critical thinking skills to successfully analyze their situation in order to make effective changes. The flexibility students must possess to be successful in making change is a relevant 21st century skill. Both critical analysis and flexibility also are integral to the creative process, and thereby meaningful for this researchers' study in creativity for Student-Directed Inquiry as compared to Teacher-Directed Inquiry. Sadeh and Zion (2009) recommend that more research needs to be

conducted in the area of dynamic inquiry performance as a framework to develop higher-order thinking skills.

Students who engage in open-ended inquiry as compared to guided-inquiry are required to carve their own path towards a solution. They must develop their own hypotheses and processes. This type of challenge for students sometimes leads to frustration (Chatterjee, Williamson, McCann, & Peck, 2009; Fishback & Daniel, 2011). In a study by Chatterjee et al. (2009), 703 general chemistry students (274 males and 429 females) participated in both open and guided-inquiry laboratory experiments. At the end of the semester students completed a three-part survey. The first part consisted of biographical questions. The second part asked students to analyze scenarios and determine if they represented open or guided-inquiry. The third part was an attitude survey on inquiry laboratories.

Results of the section of the student survey that required students to identify the type of inquiry based on a given scenario indicated that 53.49% of students could identify the open-inquiry scenarios. Guided-inquiry scenarios were accurately identified by 77.81% of the students and 45.80% ($n = 322$) were able to identify both correctly.

The results of the attitude section of the survey for students, who were able to identify both types of inquiry, were analyzed. A Chi-square analysis was performed. On the survey section inquiring about guided-inquiry, 82.10% of students agreed that they liked guided-inquiry laboratories and 81.37% agreed that guided-inquiry laboratories and reports were easy to do. In contrast, when completing the section of the survey on open-inquiry, 62.73% of students agreed that they did not like open-inquiry laboratories and 56.21% agreed that the laboratories and reports were hard to do. It was also reported that many

students did not find open-inquiry laboratories fun to complete (53.40%). Students preferred to have the procedure given to them and 76.71% would choose a guided-inquiry laboratory over an open-inquiry laboratory. Students also reported that they felt they learned more with guided-inquiry laboratories (45.96%) as compared to the 22.05% who felt that they learned more with open-inquiry laboratories.

Students felt more supported during the guided-inquiry laboratories. The level of ambiguity was less and this could have contributed to the ease of completion for these types of labs, as well as the perceived fun and learning on behalf of the students. The effects of students' positive attitudes toward learning and their perception of greater achievement have been linked to the guided inquiries as compared to the open-inquiry process. The implication for this researcher's study is that if students struggle with ambiguity, it may lead them to dislike open-inquiry investigations.

Berg, Bergendahl, Lundberg, and Tibell (2003) conducted a study in Sweden that explored the relationship between student attitudes and outcomes when using either open-inquiry or expository methods during chemistry classes. The sample included 190 first year chemistry students at the university level.

Over the course of 20 weeks, college students ($n = 190$) engaged in laboratories. In the first semester, first year students from various science programs of study were assigned to either expository ($n = 65$) or open–inquiry ($n = 40$). To create similar classes, students were assigned to groups based on their demographics. In the second semester, 85 students, primarily engineering chemistry students, performed the laboratory with a revised version of the open-inquiry process, creating a third level in the independent variable of the treatment. Students in the expository group were given a prescribed procedure with a predetermined

outcome for their laboratories. They were given detailed instructions for how to do each phase of the experiment. In the open-inquiry version, students were presented with the task of comparing two catalysts in any way they deemed appropriate and needed to develop a hypothesis and procedure, then discuss the analysis of their results. In the revised open-inquiry group, students were informed that the planning and evaluation of the process were valued as well as the scientific portion of the laboratory. Students were also given a checkpoint mid-way through the experiment. This provided an opportunity for students to discuss their progress and future plans for the lab work with the teacher. This informed the instructor of where students became confused and where they would benefit from scaffolding to avoid frustration.

An attitude questionnaire was administered to all students to establish their attitudes towards chemistry in relation to their peers. Based on the degree of their positive attitude towards chemistry, students engaged in follow-up interviews. Those who scored low ($n = 3$) and high ($n = 3$) on the questionnaire were selected. Six students from each of the treatment groups, the expository, open-inquiry, and revised open-inquiry, were selected for follow-up interviews in the same manner with a total of 18 students participating in interviews. In addition, student questions during laboratories were analyzed. Student self-evaluation questionnaires were administered to all students delineating the time spent on planning and preparation for the experiments, their opinions of the experiments and proposed improvements, and a self-assessment of learning outcomes. Interviews were also conducted with the laboratory instructors.

Based on the interviews, interesting findings in this study were that students who had participated in the open-inquiry versions of the laboratory, regardless of high or low positive

attitudes toward chemistry, could describe their processes, evaluate their experiments, and make suggestions for changes in the experiment, and pose new questions to research. Whereas, in the expository group, only half could explain their procedures and few could evaluate the experiment or suggest changes. This was evidence of higher-order thinking and greater internalization of learning during open-inquiry.

Another interesting finding based on the interviews was that students who had high positive attitudes readily accepted the challenges of open-inquiry. Students who had low positive attitudes were reluctant to accept the challenge of open-inquiry; more so in the group that participated in the open-inquiry rather than the revised version, which had more support. Students who had low positive attitudes claimed that they wanted clear instructions and they would not have time to plan their experiments.

Instructors in the three groups recorded student questions and coded them to identify the nature of the questions, such as whether the question was practical or theoretical, spontaneous or reflective, or detailed or contextual. These data suggest that the students in the open-inquiry groups were more reflective than students in the expository group when asking questions and their questions reflected higher-level thinking.

The student questionnaires revealed that students who were in the open-inquiry revised group, as compared to the original open-inquiry group and expository group, spent more time on task, working in the laboratory, and 50% of these students also claimed that they learned "a lot" from the experiment as compared with 50% of students in the expository group who claimed they only learned "a little" (Berg et al., 2003, p. 365).

The results of this study indicated that students with a low positive attitude may benefit from more scaffolding and less ambiguity as these students were more easily able to

accept the challenge of an open-inquiry when checkpoints and feedback were embedded in the experiment. All students, regardless of attitude, in the revised open-inquiry group who had a checkpoint and a stated focus for their process, seemed to be the most successful based on the triangulated data in this study. This suggests that inquiry should include clear explanations and feedback for students.

The studies in this section were conducted across elementary school through college populations in the sciences. The consensus from the research seems to be that inquiry is a more successful method of instruction when compared with traditional teaching methods. However, within the context of the levels of inquiry, scaffolding is an integral part for students' positive learning outcomes, thus leading to the conclusion that the teachers' role is to support the learning and be a guide for students. These studies validate the approach of guided-inquiry as an optimal approach to avoid frustration when in ambiguous learning situations, but open-inquiry as more successful for students gaining procedural knowledge.

Renzulli's Enrichment Triad Model

Joseph Renzulli (1976) developed the Enrichment Triad model. It is a model for education that is dedicated to nurturing the creativity, motivation, and task commitment in students and is based on the premise that guided-inquiry experiences can lead to successful open-inquiry (Renzulli & Reis, 2001). The crux of the Enrichment Triad Model is that it is grounded in exposure to a variety of high-interest topics of study, provides the development of skill-based knowledge, and provides opportunities for students to apply their learning to solve an authentic problem. There are three levels in the model. Type I enrichment provides introductions for students to new topics, hobbies, disciplines, occupations, cultural interests, and more, through presentations from speakers, videos, demonstrations,

performances, and so forth (Renzulli & Reis, 2001). Type II experiences are activities designed to teach relevant skills for creativity and strategies for problem-solving within the context of the area of study (Renzulli & Reis, 2001). These skills support students who have the desire to continue on to more in-depth study in the Type III experiences. The latter includes self-selected areas of study where students investigate and solve real-world problems, utilizing the process skills learned in their Type II experiences. In a Type III activity, students develop a novel and meaningful product or solution that they then implement or create. Renzulli's Type III experiences provide a problem-based learning approach for students and are part of an open-inquiry framework.

Although developed as a model for gifted students, Renzulli (2001) concluded that Type I and Type II experiences should be available for all students and that students should have the opportunity to pursue Type III activities. The Enrichment Triad Model has been applied to both gifted and non-gifted populations.

The present study utilized the plan of the Enrichment Triad Model to implement the service learning component of the study. This study incorporated the three types of enrichment activities, and offered a variety of experiences to develop the creativity of students in the Student-Directed Inquiry model. It was also inherently problem-based in its approach to learning. Moreover, Renzulli (2001) built his model on the belief that students who enjoyed what they were learning would engage at a higher level and in turn learn more. He valued the student choice element as well as the authenticity of learning opportunities, as evident in his model.

The Renzulli model has been researched significantly across student populations and positive outcomes have been found (Baum, 1988; Reis, 1981; Taylor, 1995). Renzulli

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extended his framework to a Schoolwide Enrichment Model that incorporated teacher training in instructional practices to bring opportunities for Type I, II, and III experiences to all students in a school.

In 1981, Dr. Sally Reis conducted her dissertation research on the Schoolwide Enrichment Model. Within this model, all students in a school are provided Type I and Type II experiences, but only a select talent pool participated in Type III projects. Reis's research extended the traditional talent pool of gifted students from the top 5% as indicated by IQ or achievement tests, to include the top 25% of students based on academic achievement, and expanded the pool further to include students who were recommended to participate in Type III experiences. Reis sought to learn about students' motivation for creative productivity by gender and age grouping.

The research was conducted over two years. The first year was a pilot study with one school district. Then, utilizing a sample of 1,162 students from 12 school districts over the second year, students in the expanded talent pool revolved into gifted programs for Type III experiences. Utilizing the Student Product Assessment Form a valid and reliable teacher rating scale, students' products were assessed.

Reis (1981) examined the effects of age and gender on motivation for creative productivity. It was found that a significantly higher proportion of females than males revolved into the program and completed projects ($z = -2.07$, $p < .05$) and a significantly higher proportion of 4th through 6th graders as compared to kindergartners through 3rd graders who revolved in and completed projects ($z = -4.96$, $p < .05$). An analysis of variance (ANOVA) was utilized to analyze the quality of the projects submitted by students in the top 5% and the rest of the expanded talent pool, the next 20%. No significant

differences were found between the quality of the projects across academic achievement groups, nor between males and females.

The study also had a qualitative component in which data were collected through surveys and reports from multiple constituency groups including parents, principals, teachers, and students. Responses were overall very positive about the program and included notations that students were highly motivated, students felt efficacious when they completed projects, and students enjoyed Type III experiences. This research justifies utilizing Type I, Type II, and Type III experiences with a larger talent pool. Dr. Reis's research was a valuable foundational study that significantly contributed to the current research in this field.

More recently, Field (2007) researched the effects of a technology-based enrichment program called Renzulli Learning that was developed from Renzulli's Enrichment Triad Model and Schoolwide Enrichment Model (Renzulli, 1976; Renzulli & Reis, 1997). This study sought to examine the effects of Renzulli Learning on third through eighth grade students' achievement in reading fluency, reading comprehension, social studies, and science.

Two schools participated in this quantitative, experimental study, an upper middle class, suburban elementary school in California, and a low-income, urban middle school in Atlanta, Georgia. Each school had randomly assigned heterogeneous treatment and control groups ($n = 383$). The students in the treatment groups utilized Renzulli Learning for two to three hours over the course of 16 weeks. The researcher utilized the IOWA Test of Basic Skills and an oral fluency as pre and posttests. Throughout this study, teachers learned how

to be facilitators to student learning, and relinquish their traditional roles as direct instructional providers.

Repeated measures ANOVA procedures were used to analyze the quantitative data collected from the fluency and ITBS pre and posttests. Field (2007) reported that students who participated in Renzulli Learning demonstrated significantly higher reading comprehension ($M = 241.39$, $SD = 41.77$, $p < .001$), significantly higher growth in oral reading fluency ($M = 161.27$, $SD = 42.05$, $p = .016$), and significantly higher growth in social studies achievement ($M = 240.77$, $SD = 42.73$, $p = .013$). No significant differences were found in science achievement between groups.

Field (2007) conducted follow-up interviews and learned that students who engaged in Renzulli Learning enjoyed reading and researching according to their interests and were motivated to do so. This suggests that students were more highly engaged and in turn learned more and made greater achievement gains.

This research suggests that students who guided their own social studies research, utilizing Type I, Type II, and Type III experiences, may have been more highly motivated to learn and engage in learning activities. This information guided the development of the present study as a sound rationale for utilizing Renzulli as a model for the Student-Directed Inquiry group treatment in social studies.

Problem-Based Learning

Problem-based learning is a student guided-inquiry method of instruction (Hmelo-Silver, Duncan, & Chinn, 2007). The application of knowledge and skills is the primary objective in problem-based learning. Students guide the learning by seeking out the information crucial for solving their problem; they then analyze and adjust their hypotheses

as they move towards the solution. "The problem-based learning process was designed to cultivate higher-order thinking skills and a flexible knowledge base. Working on complex, real-world problems helps learners construct more flexible ways of knowing and more productive ways of thinking that allow learners to understand how and when knowledge can be applied" (Hmelo & Ferrari, 1997, p. 417). Teachers' roles in problem-based learning are that of a resource, guide, or coach (Shore et al., 2007). Lessons are scaffolded to support student success. Problem-based learning also puts forth opportunities for students to collaborate. Collaboration, communication, inquiry, initiative, creativity, critical thinking, accessing and analyzing information, problem solving are important skills for the 21st century learner (Wagner, 2008).

In a study of the teaching of mathematics using a project approach, Boaler (1999) poses the question, "Is success on a short, procedural test the measure we want to adopt to assess the effectiveness of our students' learning? In other words, do these tests assess the sort of knowledge use, critical thought, and reasoning that is needed by learners moving into the 21st century?" (p. 30). In essence, Boaler's question initiates the pondering of the goals of our education system and the conversation that has been initiated in our nation about 21st century skills. With problem-based learning, students are applying their knowledge, rather than simply collecting and storing information. Boaler (1998) conducted a mixed methods three-year study in mathematics comparing a traditional instructional approach to a project-oriented approach in 13- to 16-year-olds. She used intact groups from two different school districts, the treatment group *(n = 100)* from one school, and the comparison group *(n = 200)* from the other. The teachers, using a traditional approach, taught algorithms from textbooks with follow-up pages of pencil and paper math problems. The project-based

approach was used in the treatment group. Students were given a choice of problems to solve that required the use of mathematics. The teacher supported his or her students by teaching them the necessary skills to complete the project.

Boaler conducted interviews, administered questionnaires, and analyzed various mathematics assessments to understand the connection between the in-class mathematical experience, and students' understanding of mathematical principles. At the beginning of the research, there were no significant differences between groups, neither demographically nor academically.

While 92% - 100% of the students at the traditional school were observed to be on task and working hard as witnessed by the researcher, they reported that the work was tedious and boring. Students reported on questionnaires that the work was not meaningful, nor relevant or practical. These students were not found to be risk-takers with math. If they found a situation that they were unfamiliar with they were stymied, as they did not know the mathematical rule to aid them in solving the problem. They relied more on memorization of algorithms than understanding of mathematical situations. Students reported that they found the traditional method of learning math repetitive and expressed a desire for project work.

In the problem-based learning school, 58% - 69% of students were observed to be on task during the math class. The descriptors they shared regarding the class included "noisy, interesting, and a good atmosphere" (Boaler, 1998, p. 50). Students reported that they understood the mathematical methods they utilized and were able to explain and analyze the processes as to why they implemented the various mathematical strategies. Approximately 20% of students did not like the freedom and unstructured nature of the Student-Directed Inquiry. They felt it was difficult to stay on task and found the noise level distracting. They

were disinterested in finding things out for themselves and preferred direct instruction and clear expectations of outcomes.

At the end of each year of the study, the researcher gave the students an applied task and a short answer test. She found that students who engaged in project learning performed better on tasks that required applied knowledge, yet there were no significant differences on the portion that required procedural knowledge. On the national exams taken at the end of the 11th grade, significantly more students at the problem-based school passed the test ($\chi^2(1, n = 332) = 12.54, p < .05$). An interesting note is that at the traditional school, there was a significant difference in the performance of males and females ($\chi^2(1, n = 217) = 3.89, p < .05$). Of the males in the study, 20% passed the examination at the higher level gaining them entry into advanced course study, whereas only 9% of the females passed at the higher level. In the problem-based school, there were no significant differences in the achievement of males (13%) and females (15%) at the higher level. It was concluded that students had gained applied knowledge through PBL methods, rather than the nontransferable or procedural knowledge their traditionally educated peers had obtained. This applied knowledge was an example of critical thinking skills. The other benefit of this study was that academic achievement in mathematics, a core academic subject, was not only maintained, but improved through problem-based learning.

PBL has been utilized successfully across academic disciplines. In Boaler's (1998) study, students were given real-world problems to solve that involved mathematics. Students reported that they found the PBL method interesting. One conclusion from this study was that students must be interested in order to learn and be motivated. Therefore, motivation to learn is a significant factor in PBL.

Liu and Hsiau (2002) conducted a study with middle school students as multimedia designers to discover the effects of a situated learning project on students' motivation towards learning. The participants *(n = 16)* were in an elective course on multimedia. The sample was comprised of 7th and 8th graders and included 5 females and 11 males, ages 12 to 14. Students rated themselves on their computer skills and 80% rated themselves as 4 or above on a 5-point likert-type scale, with 5 being "very good" and 1 being "not good at all." At a level 3, 20% of students ranked themselves. Four students were enrolled in this class for the second time. The students worked on the computer for two-thirds of the course, for the other third, they were taught related curriculum. The course ran for 18 weeks for 45 minutes a day.

The course was implemented in three phases. In the first phase, students were taught how to use the multimedia tools necessary for the creation of a multimedia project. For the second phase, students worked in teams to create a large project, each team having a different aspect of the topic. The art and multimedia teachers as well as researchers provided support and scaffolding for the students by offering additional instruction, directions, and suggestions as they worked through the various planning and organizational stages of their projects. Students had access to authentic multimedia tools, and took on authentic roles, as would a real team of multimedia designers. As the projects progressed, students reflected on their progress, sought out feedback from the teachers and researchers, and made adjustments. The final phase was the independent application of their learning as students were charged with making their own websites. Phase three was largely independent.

Students answered selected questions from a motivation questionnaire before and after the course and data were evaluated with paired *t*-tests. Students also completed questionnaires about project design, task ranking, and they completed concept maps. The researcher collected qualitative data that included student reflection logs and interviews.

Students' pre/posttest *t*-tests indicated that there were significant differences in motivation. Student significantly increased their scores in the areas of task value ($t = -2.62$, $p < .05$), learning belief ($t = -3.39$, $p < .01$), and self-efficacy ($t = -2.28$, $p < .05$). Scores decreased significantly in intrinsic goal ($t = 2.47$, $p < .05$) and they decreased in extrinsic goal ($t = -2.03$, $p < .062$), although not at a significant level. There were no significant differences in the pre/posttest results for project design. The task ranking survey indicated that students felt the planning and organization tasks were more important than the technical aspects of making the presentations. There was also a significant difference ($t = -3.14$, $p < .01$) in the number of concepts that were accurately listed on the concept maps from pre to posttest.

The qualitative data supplied some interesting insights and provided context for the quantitative data. Students reported that they gained an appreciation of the planning phase through this project and felt confident about their abilities going forward. Students found time management to be a challenge, but offered positive responses regarding teamwork and the group contribution to problem solving. Students noted that they found it difficult to work within the environmental constraints, as there were two computer labs that students worked in. This led to student groups not always being in the same place at the same time, thus making it difficult to meet and manage the project or problems that arose. The value of the skills learned during the project was recognized, but they also reported getting bored

with the process by the time they were creating their own websites in phase three as they found it repetitive. This perhaps explains the decrease in intrinsic and extrinsic motivation. Students reported being less interested as the process and skills became less novel. However, the acquisition of 21st century skills was validated utilizing the PBL method, even when tasks lost their newness. One conclusion was that teachers must be aware of the novelty factor when implementing authentic and motivating PBL experiences for students in order to sustain a high level of interest. The qualitative data also suggested that scaffolding was critical to the success of the students.

Alacapinar (2008) conducted a quasi-experimental study using a convenience sample of 42 fifth grade students to study the effectiveness of project-based learning. Two randomly selected fifth grade classes were assigned as experimental and control groups. Classes were equal in terms of demographics and academic performance in social studies. The treatment group and comparison group *(n = 21)* both studied a similar curriculum in social studies. The experimental group used a PBL approach. The control group used traditional methods of instruction.

Qualitative data were collected in three ways; an interview, video recordings, and a project evaluation and portfolio for the experimental group. The reliability of the interview form was .73 and experts confirmed the validity of the questions. The project evaluation form measured cognitive achievement levels and had a reliability of .84 and experts were consulted for the validity. For the quantitative analysis, students were also given a 15-question cognitive test, both pre- and post- treatment. The test measured cognitive ability to synthesize social studies course learning, as well as processes utilized during project work, and outcomes. Areas that were targeted for assessment in the test were: "problem

identification; planning for research and investigation; suggesting a new and original solution; examining ways of solution already known; preparing materials and tools and finding relevant reading sources; collecting, analyzing, and interpreting data; drafting and submitting the report; and working with classmates, teachers and experts" (Alacapinar, 2008, p. 25). The 15 test questions had a reliability of .79 as determined by a reliability study, and was used to calculate application levels of achievement.

The pre-test was used in conjunction with grades, and demographic information to ensure that the groups were equal. Data analysis included t-tests and no significant differences between groups were found in the pre-test. The posttest however, indicated that students in the treatment group performed significantly higher than the control group in cognitive achievement ($t = 13.46$, p values were not provided). Moreover, students in the treatment group performed significantly higher in areas of higher order thinking such as suggesting a new and original solution as well as in analyzing and interpreting data ($t = 36.87$). The study also concluded, through qualitative research, that PBL enhanced creativity and helped them acquire high-level information and other 21st Century skills such as collaboration and communication. The students reported that the project technique improved their affect by consolidating affinity, trust, and friendship amongst the peers with whom they collaborated. Based on the quantitative data and the data collected through focus groups, Alacapinar (2008) suggested that "By establishing connections between the project technique and daily life students can be motivated further" (p. 29).

Twenty-first century skill acquisition in Alacapinar's study was evident in fifth graders. As students enter the workforce, these skills become more important (Wagner, 2008). By having experiences in PBL, high school graduates have a sense of confidence

about their life skills as reported in this 2011 qualitative study of alumni from a secondary school in Minnesota (Wurdinger & Enloe, 2011). The Avalon Charter School was established in 2001 as a school dedicated to utilizing the methods of PBL as the primary method of instruction. The school was developed on the premise that "when students have a sense of ownership of their work and the life-world of their school, student's achievement will increase" (Wordinger & Enloe, 2011, p. 84).

Alumni *(n = 42)* who graduated between 2004 - 2009 completed an online survey. Former students who responded were in a variety of post-graduate placements including attending college as undergraduate, master's, and technical program students. Four students did not complete their higher education programs. The rest were in-progress or completed. Of the respondents, 27 students were employed and 13 were unemployed.

Students were asked multiple questions including identifying the skills garnered at the Avalon school, what skill deficits they felt they had, and if they felt their education gave them an advantage over their college peers. Students also ranked their academic performance before and after attending the Avalon Charter School.

Responses to the questions were coded and themes emerged. Students reported that they had learned to be self-directed learners. They also reported acquiring skills such as leadership, teamwork, and time management. Students included research, writing, community involvement, and organization, among other skills learned. Students identified test-taking and note-taking skills as weaknesses in addition to the curricular area of mathematics. However, students reported they felt they had acquired superior life skills. Those life-skills ranked most highly were creativity, problem solving, decision-making, learning how to learn, and responsibility. It was reported that 88% of responders agreed that

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they felt the skills they learned at Avalon gave them an advantage over their regularly

educated peers and 90.5% agreed that the Avalon school prepared them to meet their goals

after graduation. Eighty-eight percent of responders felt that they had advantages beyond

their peers in life. Students noted that they had more confidence, more flexibility and

adaptability, and valued community more so than their peers with traditional educational

experiences. Students also reported their achievement as greater at Avalon than in prior

school settings. The authors hypothesized that motivation was enhanced when students

were free to choose areas of study based on their interests and when they were based on

real-world outcomes (Wurdinger & Enloe, 2011).

  These studies suggested that there was a link between PBL and the acquisition of

21st century skills. These studies also demonstrated that PBL can be utilized effectively to

increase student interest in learning and motivation, and in turn achievement across

disciplines. Students' higher-order thinking in terms of creativity, synthesis, and analysis of

information was evidenced by these studies as well. This information was a foundation for

this researcher's study as the PBL method was selected to be paired with the Student-

Directed Inquiry approach to instruction.

  Creative Problem Solving (CPS) method and service learning. The Creative

Problem Solving Method (CPS) originated with the work of Dr. Alex F. Osborn (1967). It

is continued today by multiple experts, most notably Dr. Donald J. Treffinger and Dr. Scott

G. Isaksen. The CPS method engages students in a series of phases in which students use

convergent and divergent thinking to solve problems. Higher order thinking is inclusive of

both creative processes such as synthesis, and critical thinking processes that utilize

evaluation strategies and analysis. Students use the various stages of CPS to arrive at a

novel and viable solution. See Table 2 for more information regarding the CPS method.

Table 2

The Main Components and Six Specific Stages of CPS

Phases	Divergent Thinking	Convergent Thinking
Mess Finding	Seeking opportunities for problem solving	Establishing a broad, general goal for problem solving
Data Finding	Examining many details, looking at the mess from many viewpoints	Determining the most important data to guide problem development
Problem Finding	Considering many possible problem statements	Constructing or selecting a specific problem statement (stating the challenge)
Idea Finding	Producing many, varied, and unusual ideas	Identifying promising possibilities, alternatives, or options having interesting potentials
Solution Finding	Developing criteria for analyzing and refining promising possibilities	Choosing criteria, and applying them to select, strengthen, and support promising solutions
Acceptance Finding	Considering possible sources of assistance/resistance and possible actions for implementation	Formulating a specific plan of action

Isaksen & Treffinger (1985)

Creative Problem Solving can be a highly effective instructional strategy in service learning. Citizenship education is a significant part of the curriculum in New Zealand (Sewell, Fuller, Murphy, & Funnell, 2002). Teachers are accountable for providing opportunities for students to engage in authentic civic actions as part of their instruction. Two case studies were presented by Sewell et al. which recounted the successful incorporation of CPS in social studies. Sewell et. al (2002) emphasized the need for modeling each phase of CPS through a practice problem that was similar in nature to a future problem solving opportunity. An important component was the teacher modeling reflective thinking at each juncture. The utilization of CPS in the classroom included application to genuine problems beyond the classroom.

The first case study was in a second grade class. Students worked collaboratively to identify areas of concern around their school building. The teacher worked with the students to facilitate each of the CPS phases. Students discovered there was a problem with litter on the playground. She helped them ask questions and recognize problems, gather information, make observations, analyze data, conduct research, brainstorm solutions, critically analyze viability of solutions, and implement a plan of action. Students flowed in and out of the various phases of CPS throughout the process, eventually making discoveries about how and why the litter was on the playground. Students presented their findings through skits they presented to their peers.

The second case study involved a sixth grade class with a similar charge, to find areas of concern around their school building. The teacher modeled the CPS process for students with a parallel problem of her own. Students then began to address their task. Three groups of students found unique problems including a dull school sign, a bland fence,

and a messy hallway. The groups, having learned the CPS process from the teacher

modeling, began with the initial phases of problem solving. Students found viable solutions

to their problems, however, it was observed that without the teacher guiding each step of the

process, students often rushed toward a solution. It was also noted that students produced

higher quality work and tolerated fewer errors for themselves as they viewed this as an

authentic experience. Students also expressed that they felt they made a difference.

These cases impart the value of modeling CPS prior to engaging in the problem

solving processes independently. Also highlighted by this study was the need for teacher

facilitation as students engaged in CPS. It was reported in this study that students responded

positively to the authentic context.

Service learning as a problem-based strategy for instruction. Problem-based

learning has been widely connected with service learning. Although the term Problem-

Based Service Learning is not in widespread use, the accuracy of the description is inherent

in the process. Service learning combines curricular goals and objectives, with community

service. The intention is to apply what students learn in the classroom to solve real,

authentic problems in the local community or the world (National Service Learning

Clearinghouse, 2011).

Ohn and Wade's (2009) qualitative study investigated the effectiveness of a program

called CiviConnections that integrated historical inquiry into service learning. The

researchers used pattern-matching logic to analyze data taken from interviews, teacher

reports, student work samples, and interviews. The researchers were searching for a

relationship between the implementation of the program and teachers' perspectives of

citizenship. The surveys measured teacher attitudes towards citizenship as well as their

experience and knowledge about historical inquiry and service learning. Teacher participants included 13 elementary school teachers and 19 middle school teachers. Two-thirds of the middle school teachers who participated were social studies or history teachers. Based on the results of the survey, 11 teachers were selected to participate in interviews based on their consistency of response patterns regarding their perspectives of social studies in terms of purpose, content, and teaching methods. Although there was teacher training on historical inquiry, teachers had varying approaches to implementing the CiviConnections program. Teachers differed in the amount of inquiry initiated by students when compared to Teacher-Directed Inquiry. Some of the variation was due to teachers' own perspectives of citizenship and historical inquiry; also differing between teachers was the number of opportunities for reflections about service by the students. Teachers' prior knowledge of content did not affect the way teachers presented the inquiry. Although the CiviConnections program was implemented in various ways, the results suggested that the most effective ways to implement service learning included group inquiry projects where the students' learning was tailored to specific community issues, and students were taught the process skills of inquiry and decision-making skills within the specific disciplines (Ohn & Wade, 2009). These process skills enabled students to successfully apply their knowledge. This study reinforced the value in the teaching of process skills within a problem-based service learning instructional approach.

One of the process skills integral to problem-based service learning is divergent thinking. Divergent thinking is often referred to as an aspect of creative thinking or open-ended thinking. In the divergent or creative portion of problem-solving, students use brainstorming, making free associations, and thinking in novel, unique ways. Another

important part of the process of problem-based service learning is convergent thinking. Students must take the information they have amassed and critically analyze it for efficacy. The Creative Problem-Solving method (CPS) utilizes both the divergent and convergent processes to solve problems (Isaksen & Treffinger, 1985). In the following study, the CPS method was shown to be a viable strategy for teaching important process skills for service learning. The CPS method provided students with tools for effective decision-making. These process skills when embedded in service learning helped build students' self-efficacy and their sense of civic responsibility.

Alice Terry (2003) conducted a two-year, qualitative study exploring the effects of service learning on young, gifted, adolescents within their community. Four research questions addressed students' perceptions about their participation, how participation in service learning impacted students, how the service learning project impacted the community, and whether the instructional methodology used influenced the students' experience. The study included 28 identified gifted students from a school in rural Georgia. Data were collected in the following ways: open-ended individual interviews with students, parents, the teacher, and administrator; focus groups including multiple observations throughout the two-year project; and documents. All data were coded and triangulated, and six themes emerged. One theme was the instructional methodology of CPS. Students were not as familiar with the convergent parts of the process, but had more experience with divergent tactics such as brainstorming. Terry (2003) found that gifted middle school students using CPS methods during service learning felt "empowered to make decisions and take actions on their own" (p. 302). Students reported that they could rely on the teacher for guidance, but they were in charge of the decision making used in their projects. The student

facilitator of the project reported that some students who were not experienced with the CPS process, or the freedom to problem solve independently, needed more support to apply the steps in the CPS process. This sense of empowerment was found to be relegated to the classroom activities as part of the service learning and did not extend to students' sense of empowerment in community action. While feeling empowered, students expressed doubts as to whether or not they could make a difference in their community at the culmination of the project. Commitment was another theme that emerged. Students reported an increased commitment to their community because of the service learning project. The teacher reported that she believed it was due to the fact that they had selected the project. Terry (2003) also reported that, students had a broader view of their world beyond just themselves. Moreover, "their appreciation of their community grew," and, "students' sense of responsibility toward their community developed" (p. 305).

Researchers have suggested that service learning should be implemented over an extended period of time to have an impact on students (Billig, Root, & Jesse, 2005). A quasi-experimental study conducted by Scales, Blyth, Berkas, & Kielsmeier (2000) examined the effects of service learning on middle school students' social responsibility and academic success. The project included a diverse population of 1,153 sixth through eighth grade students, from 29 schools with established service learning programs, who were randomly assigned by intact classes to either a treatment group that participated in a service learning project, or a control group that did not. The treatment varied by school in the duration, amount of reflection, and students' prior experience with service learning. The middle school teams were balanced in gender, ethnicity, and academic performance. Approximately 53% of the participants were girls; 47% were boys. Chi-square tests

established no significant differences between treatment and control groups at the start of the study in the area of socio-economic status, parent education, prior participation in service learning with reflection, or geographic stability of the participants. There were 10 instruments used to collect data including instruments that measured; social and personal responsibility, personal development, parent involvement, commitment to class work, engagement with school, perceived scholastic competence, intellectual achievement responsibility, students goal orientation, academic achievement, and conduct. All 10 instruments were combined in a single instrument, The Survey of Middle School Student Life, and given to students as a pretest and posttest at the beginning and end of the year. Data were analyzed using a series of Analyses of Covariance procedures (ANCOVA). Results indicated that students "who had done 31 hours or more of service learning had higher posttest scores than all other students on their perceived self-efficacy in helping others, ($F(4, 936) = 6.22$, $p < .001$)" (p. 332). In addition, students in the treatment group who participated in service learning "were more concerned with the welfare of others than [were those in] the control group ($F(1, 158) = 5.73$, $p < .01$)" (p. 346). The results of this study were valuable to this researcher as they suggested 31 hours or more of service learning treatment to be most effective in building students' civic responsibility.

In a review of research by Conrad and Hedin (1991), service learning has also been connected to an increased ability in student problem solving. Furthermore, students' ability to analyze problems improved due to prior experiences with similar problems. Conrad and Hedin (1982) conducted a quantitative study of 27 different experiential high school education programs which included voluntary community service, community study and political action, adventure education, and career internships, as compared to 6 non-

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experiential classroom based programs that explored similar topics omitting the field work component. The evidence garnered showed that experiential programs had a positive effect on students' social, psychological, and academic development.

Service learning was not a coined phrase at the time of the study conducted by Conrad and Hedin. However, the requirements of the experimental programs to participate in the study included learning by doing in authentic settings outside of the classroom with curricular connections, and using reflection. All but three of the programs were high school elective courses. Programs included voluntary community service, internships, community study/political action, and adventure programs. Programs varied in duration and intensity, as well as amount of reflexive practice. Some programs were electives, others mandatory. Student demographics differed in terms of socio-economic status and geographical location. Programs were selected purposefully by excellence in reputation.

The researchers in this study examined many factors via pre/posttest including social factors such as levels of personal responsibility and attitudes towards others. Also investigated were student participation in the community and students' self-esteem. Of particular interest, was the research on students' knowledge of community issues and resources.

The results showed that students who participated in experiential learning had greater self-worth, especially those who participated in outdoor education programs. Students in experiential programs with service components showed significantly higher results in moral reasoning skills than students in comparison groups who did not participate in service activities. Twenty-three of the 27 experimental groups showed statistically significant growth in the area of social and personal responsibility, which included students'

sense of competence and performance, social efficacy, and sense of duty. Data for F and p values were not reported. The indicator of taking responsible action showed the strongest change from pre to posttest. Students in service programs had the greatest gains in their attitudes toward being active in the community. Students in community study and outdoor programs had significant increases as well, while students who were classroom-based decreased on this measure. On an academic self-report, students from 25 out of 27 experiential programs reported that they felt they had learned more than in a typical classroom. Moreover, students from 21 out of the 27 programs also showed increased mean scores in social problem solving, while 5 of the 6 comparison groups showed decreases. Programs that focused on problem solving by exposing students to problems and then held debriefing seminars were most successful. Another program strength that led to the most positive changes in students was a weekly seminar where students engaged in reflection. Programs that lasted 18 weeks were more successful than those of shorter duration.

Conrad and Hedin concluded after studying the various types of programs and student responses, that students made the most personal gains in areas such as self-esteem when doing things autonomously, but the most positive gains in social attitudes and reasoning were attained when they had access to an adult mentor in a collegial, non-judgmental way.

Based on their research, many experts agree that service learning has significant benefits for students. Conrad and Hedin's 1991 article lends support to the methodology of a problem-based experiential approach for developing critical thinking through service learning. Joseph Renzulli and Sally Reis (1997) advocated service learning as a method that provided (gifted) students with authentic challenges and opportunities to problem solve

while developing skills that will be useful in the real world. It is this researchers' purpose to

add to the body of research that demonstrates the value of service learning in the area of 21st

century skill development.

CHAPTER THREE:

METHODOLOGY

Chapter Overview

This study was designed to measure the extent of the effects of problem-based service learning (PBSL) as a Student-Directed Inquiry approach as compared to a Teacher-Directed Inquiry not utilizing problem-based service learning, on eighth graders' motivation to apply creative problem solving and critical thinking, and as a measure of its impact on students' sense of civic responsibility. This chapter will provide descriptions of the setting and subjects, instrumentation, research questions, research design, treatment, and timeline of the study.

Setting and Subjects

The participants in this quasi-experimental study were eighth grade students. The students were selected from intact classes in two demographically similar districts in the Northeast. Students in one district volunteered to participate in the Student-Directed Inquiry group, and students from the other district participated in the Teacher-Directed Inquiry group. This was a convenience sample as these subjects were available to the researcher.

The Student-Directed Inquiry group that utilized PBSL was from a small, middle-class, suburban school district in the Northeast. The town population was fairly stable with approximately 7,800 residents and student enrollment had little attrition from one year to the next. Per pupil expenditures were $25,543 in the 2008 - 2009 school year and median household income was $98,713. There were approximately 125 students in the eighth grade. All eighth grade students from 6 sections of social studies were invited to participate in the study. Out of the entire grade, 44 students agreed to participate and 29 ($n = 29$)

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students completed the study. There were 11 males and 18 females in the Student-Directed Inquiry group. Both eighth grade social studies teachers delivered the instruction on Creative Problem-Solving (CPS) techniques (Isaksen, & Treffinger, 1985) needed to complete the PBSL project. Teachers volunteered as facilitators during an advisory period to support students in applying the creative problem-solving aspect of the service learning projects.

The students in the Teacher-Directed Inquiry group were from a middle school with similar ethnic demographics ($n = 32$). See Table 3 for further demographic information of subjects for both groups. Per pupil expenditures in 2008 – 2009 were $13,463 and household income was $67,835. This group was comprised of 14 males and 18 females. There were 10 social studies classes at this school with a total of approximately 225 students. A sample of convenience was taken from five intact classes each with approximately 22 eighth grade social studies students. The other five classes were involved in an alternate study and were unavailable to this researcher. All students were asked to voluntarily participate. Those who agreed became part of the sample.

Table 3

Ethnic Identification of the Student Sample for Both Groups

Ethnicity	Student-Directed Inquiry Group Utilizing PBSL	Teacher-Directed Inquiry Group
African/African American	0.0%	3.1%
American Indian/Alaskan	0.0%	0.0%
Asian/Asian American	10.3%	3.1%
Latino/Hispanic	13.8%	6.3%
White/Not Hispanic	75.9%	84.4%
Other	0.0%	3.1%

Instrumentation

California Measure of Mental Motivation

The California Measure of Mental Motivation (CM3) was designed on the premise that critical thinking is linked to student engagement, and motivation toward intellectual activities that involve reasoning (Giancarlo, 2010). The instrument that was used in this study to assess intrinsic motivation to apply critical thinking skills is the California Measure of Mental Motivation, Level II+ (CM3). It was specifically designed for students in grades 6 -12. Administration takes approximately 20 minutes and can be delivered as a pencil/paper test, or online. In this case, it was administered as a pencil/paper test. Students answer 72 questions on a Likert-type scale with the answer choices of agree strongly, agree, disagree, or disagree strongly. Students fill in bubbles on a separate answer sheet that is later scanned and scored by Insight Assessments Corporation.

The purpose of the CM3 is to measure the following dispositional domains of critical thinking: Mental Focus, Learning Orientation, Cognitive Integrity, Creative Problem Solving, and Scholarly Rigor. The CM3 results are reported as scale scores of up to 50 points per scale. The Mental Focus subscale is comprised of three factors: process, organization and attention. The Mental Focus subscale measures an individual's motivation "to be diligent, focused, systematic, task-oriented, organized, and clear-headed while engaging in a mental activity" (Giancarlo, 2010, p. 7). Individuals who score high on this subscale exhibit these traits. Low scores on this subscale indicate that a person may have difficulty with organization, maintaining focus or attention to tasks, or find problem solving challenging or frustrating.

The factors that comprise the Learning Orientation subscale are the desire to learn and to gather information. The Learning Orientation subscale measures the degree to which an individual values learning and considers gathering evidence as a requisite part of decision making. Students who score high on the Learning Orientation subscale are inquisitive and thorough investigators prior to making a decision. Those who score low on this scale are less curious and often make decisions without collecting relevant information, perhaps not valuing it, not being able to do so, or not realizing the necessity to do so (Giancarlo, 2010).

The Creative Problem Solving subscale is comprised of the factors of innovation and challenge seeking. Individuals who score high on this subscale have novel ideas and enjoy engaging in solving difficult problems. Students who do not score high in Creative Problem Solving do seek out easier tasks and often do not perceive themselves to be innovative (Giancarlo, 2010).

The Cognitive Integrity subscale measures open mindedness and truth seeking in individuals. Students who score high in Cognitive Integrity are inquisitive and seek out various viewpoints before making a decision. Those who score low on this scale are quick to make a decision without all the facts or information available. They often do not care about other viewpoints. The factors measured by the cognitive integrity subscale are intellectual curiosity and fair-mindedness.

The Scholarly Rigor subscale assesses the disposition to achieve deeper understanding of complex texts, tasks, situations, or abstract materials. Students who score high in scholarly rigor are diligent workers who are analytical thinkers and enjoy challenge and complexity in learning.

There are several uses for the CM3 including program evaluation to measure curricular effectiveness in terms of learning outcomes involving critical thinking skills, group assessment of entrance or exit-level critical thinking skills, and for individuals as a measure for placement, admission, or advising (Giancarlo, 2010). The CM3 creators rationalize that, "it is not sufficient to expect that a person who is able to think critically or creatively will in fact do so. The person must also be willing and inclined to use his or her thinking and creative ability" (Giancarlo, Blohm, & Urdan, 2004, p. 361).

Scoring. The test makers calculate scores for each subscale based on the average of the associated factors. These scores are on a 50-point scale. Scores ranging from 0 to 9 points represent individuals who are strongly negatively disposed toward the particular attribute. Scores ranging from 10 to 19 are somewhat negatively disposed toward the attribute. Values of 20 to 30 points represent persons who are ambivalent toward the dispositional attribute. Scores ranging from 31 to 40 points represent individuals who are

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somewhat disposed to the attribute, and scores of 41 and above represent individuals who are strongly disposed toward the attribute (Giancarlo, 2010, p. 26).

Reliability and validity. The internal consistency of the CM3 was evaluated with Cronbach's alpha coefficients ranging from .53 to .83 for the various scales (Giancarlo, et. al, 2004). To assess external validity, the scales of the CM3 were compared to tools which measured student motivation and behavior that were already shown to be valid (Giancarlo, 2010). External validity was also established by correlating student motivation with classroom behavior. "All four scales of the CM3 resulted in statistically significant, albeit modest, positive correlations with mastery goals, self-efficacy, and self-regulation at the $p <$ .01 level" (Giancarlo et al., 2004, p. 358). Predictive and discriminant validity were also demonstrated by correlating the scales with academic achievement, and correlations with the Marlowe-Crowne Social Desirability index. There was no correlation between the CM3 and the Marlowe-Crowne Social Desirablity index. This indicates that the questions on the CM3 do not lend themselves to students answering them in a way that exhibits a socially desirable bias, which supports that the test is valid in terms of measuring a student's authentic disposition. The CM3 did positively correlate to standardized achievement tests, though these correlations were weak (Giancarlo et al., 2004).

The Civic Responsibility Survey

The Civic Responsibility Survey (CRS) (Furco, Muller, & Ammon, 1998) level two, was designed specifically to measure civic attitudes in middle school students engaged in service learning. It is scored on a 6-point Likert scale, from strongly agree to strongly disagree, and measures three constructs: connection to community, civic efficacy, and civic awareness. The instrument is a pencil and paper survey that is administered to students in 5

to 10 minutes. The CRS consists of 10 questions. Students complete the survey independently. Questions could be read to students and clarification of vocabulary is permitted. In this case, students did not request clarification, nor were questions read to students.

Scoring. The CRS is scored on a 50-point scale. To score the CRS, the items are totaled, and then 10 points are subtracted, to create the final overall score. No items are reverse coded. Scoring could also be calculated by subscale, using the means for each construct cluster. Higher scores reflect greater civic responsibility.

Reliability and validity. The CRS is a reliable measure and the authors report reliability for the total score at .84 (Furco, Muller, & Ammon, 1998). Each construct has reported reliability ranging from .63 to .77. See Table 3 for detailed information about the reliability of the CRS.

Table 4

Reliability of Civic Responsibility Survey

	Construct Reliability
Overall Reliability	.84
Connection to Community (Items #1, 2, 7, 10)	.63
Civic Awareness (Items #3, 4, 6)	.77
Civic Efficacy (Items #5, 8, 9)	.70

(Furco, Muller, & Ammon, 1998)

The survey was developed and based upon the theory that civic responsibility leads to civic engagement. As evidence of construct validity, gifted high-school students completed the Civic Responsibility Survey. The outcomes supported the validity of the

survey at the high school level as it accurately measured students who applied to and were selected for a Civic Leadership Institute program as rating higher in civic responsibility than students who applied for and were enrolled in an academic focused program (Lee, Olszewski-Kubilius, Donahue, & Weimholt, 2007).

Research Questions and Hypotheses

This research addressed the following questions:

1. Is there a significant difference in students' motivation to use creative problem-solving and critical thinking skills between eighth grade students who were engaged in a Student-Directed Inquiry using a PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in social studies classes?

   Nondirectional Hypothesis 1: There will be a significant difference in students' motivation to use creative problem-solving and critical thinking skills between eighth grade students who were engaged in a student directed inquiry using a PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in social studies classes.

2. Is there a significant difference in students' sense of civic responsibility between eighth grade students who were engaged in a Student-Directed Inquiry using a PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in social studies classes?

   Nondirectional Hypothesis 2: There will be a significant difference in students' sense of civic responsibility between eighth grade students who were engaged in a Student-Directed Inquiry using PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in social studies classes.

3. To what degree and in what manner did group membership and students'

   motivation to use creative problem-solving and critical thinking skills predict

   civic responsibility?

   Nondirectional Hypothesis 3: Civic responsibility will be predicted by the set of

   variables including group membership and students' motivation to use creative

   problem-solving and critical thinking skills.

Design and Analysis

The major design for the study was a quasi-experimental pre-posttest model. This design had different applications across the three research questions. Research question 1 utilized a pre-posttest design comparing group means for critical and creative thinking skills. Research question 2 utilized a posttest only design to investigate differences in civic leadership. Research question 3 utilized a multiple regression analysis.

For research question 1, a quasi-experimental, pre-posttest design was used. The CM3 (Giancarlo, 2010) was analyzed quantitatively to measure student creativity and critical thinking using a Multivariate Analysis of Variance (MANOVA). The independent variable was the instructional method. The levels were the Student-Directed Inquiry Group that utilized a PBSL project and the group that engaged in a Teacher-Directed Inquiry approach. The five scales of the CM3 served as separate dependent variables: mental focus, cognitive integrity, learning orientation, creative problem solving, and scholarly rigor.

For research question 2, quantitative data were collected using a posttest only design with the CRS as the dependent variable. The independent variable was the instructional method. The levels were the Student-Directed Inquiry Group that utilized a PBSL project and the group that engaged in a Teacher-Directed Inquiry approach. The total score of the

CRS served as the dependent variable. This design was beneficial for this research question as the CRS is a reactive measure. This design controls for testing as the main effect (Campbell & Stanley, 1963).

A one-way Analysis of Variance (ANOVA) comparing posttests of the Student-Directed Inquiry group and the Teacher-Directed Inquiry group was used to determine the difference in means. These posttest results were used to examine whether or not there were differences in students' sense of civic responsibility between the treatment groups.

For research question 3, a correlational design employing a standard multiple regression analysis was used to interpret the degree and manner in which group membership, critical thinking, and creative thinking, predicted civic responsibility. A standard multiple regression was selected as it provides a comprehensive model of the effect of the independent variables as a set Meyers, Gamst, and Guarino (2006).

As recommended by, a Bonferronni correction was used to avoid Type I errors (Meyers et al., 2006). Since the same data were used for the three research questions in the study, the alpha value was set at .017 by dividing the initial alpha level of .05 by three.

<center>**Treatments**</center>

Treatment 1: Student-Directed Inquiry Group Utilizing a PBSL Project

Students in the Student-Directed Inquiry classes participated in a PBSL project. For the service project, the students were partnered with an organization named The Afya Foundation (Afya Foundation, 2007). The Afya Foundation primarily collects unused supplies and distributes them to countries in need. For this service project, the focus for students was on fulfilling children's educational needs in Tanzania. Students selected

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Tanzania as their country of focus after viewing a presentation on Haiti and Tanzania presented by the founder of Afya.

The students received problem-based instruction in a social studies classroom 5 days per week for 40 minutes a day over a 6-week period. The projects were facilitated through advisory groups based on Renzulli's Enrichment Triad Model (Renzulli, & Reis, 1997).

Prior to the commencement of the treatment, the Type I introductory activities that introduced a topic were delivered during advisory periods. These activities served to introduce the students to the country of Tanzania, as well as the education and life of children in Tanzania. Experiences included speakers, stories from Tanzania, and videos. The purpose of these experiences was to introduce the service project, as well as motivate students to actively participate in the project and the learning. For example, students performed "looking walks" in their own school buildings to notice the differences in the facilities and materials between their own educational environment and the environment of students in Tanzania. Further information will be provided regarding the activities for the duration of the program under the header, data collection procedure and timeline.

At the genesis of the treatment, students received Type II, skill development experiences. The skills students would need for their service learning projects were identified and taught through mini-courses. These Type II experiences included direct instruction of Creative Problem Solving (CPS) (Isaksen & Treffinger, 1985), specifically critical thinking and creative problem-solving skills. This occurred in social studies classrooms through two units of study. The content of one social studies unit was the 1920s and 1930s. Students were taught the CPS process and the language of creativity and critical thinking through one of two projects. In one class, students were charged with identifying

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the most influential person of that era and defending their position through a research poster and presentation. In the other class, students chose an issue of the time such as prohibition or women voting, then students took a position on the issue, researched both sides of the topic, and participated in a debate. Students were taught specific skills such as fact finding, devising critical questions, brainstorming, and practicing higher order critical thinking. The latter included evaluating what makes a person most influential, determining important information, and synthesizing information into a new format. Students also learned skills such as utilizing technology for research, finding information that supports and disproves their position, and applying persuasive techniques in writing. Students were given considerable support and modeling as they applied each stage of the CPS process to their projects.

The second unit of study was a unit on World War II. Students again reviewed and employed the CPS process as they embarked on a new project. Students had many choices of projects. Some choices included analyzing a movie, book, or video game that was set during World War II and evaluating it for accuracy. Another activity included interviewing a family member as a primary source on the war and researching the events referenced. This time, students utilized the CPS process on a more independent level as the teacher gradually released control over the process to the students. Students were given the CPS templates they had learned and implemented in the prior unit, but were given autonomy to independently apply the process to this project. The teachers did not guide students through each step of CPS. However, the teachers were monitoring their progress through check-ins, were available at all stages of the project to support students who were having difficulty, and facilitated the use of the CPS process throughout the unit. The two social studies units,

The 1920s -1930s and World War II, were each three weeks long for a total of six weeks of instruction on the CPS process.

Type III experiences occurred during the advisory period. These experiences included the actual planning and implementation of the service project. Students utilized the CPS techniques independently, and wrote in reflection journals in this phase. Reflection journals provided a structured opportunity for students to explain their creative and critical thinking processes as they applied the CPS techniques. Advisors facilitated this portion of the treatment during the advisory period. Students self-selected to work independently or in small groups, and negotiated their way through the CPS process of identifying the problems facing students in Tanzania, the causes of the problems, the best solutions, and the feasibility of their solutions. They then planned and implemented their service projects. Students completed the final portion of the study, the actual service project, independently. Students who participated in the treatment were entered into a raffle for a technology related gift card to be received at the completion of the study.

Treatment 2: Teacher-Directed Inquiry Group

The Teacher-Directed Inquiry group was from a different school and district than the Student-Directed Inquiry group. This group did not participate in PBSL, nor did they receive the CPS training in social studies classes. They were taught the regular social studies curriculum using Teacher-Directed Inquiry methods. The researcher investigated the comparison school with regard to what specific curriculum topics were taught during the study, methods of instruction employed, and degree of critical thinking and creative problem-solving that were incorporated into the regular social studies curriculum. The

researcher learned that students were using Teacher-Directed Inquiry methods during their similar units of study.

Students in the Teacher-Directed Inquiry group engaged in the study of current events and issues that affect our society on a regular basis. The teacher provided a question for the students and then asked them to read a news article that she provided from The New York Times Upfront magazine. Students were given the question from the teacher, then the materials from the teacher. An example of a debate question is as follows: Should the government enforce stricter environmental regulations, even if they will make U.S. businesses less competitive with companies in less environmentally conscious countries? Students sought out the necessary information and analyzed it. They then formulated opinions on either side of the argument and supported it with examples from the text. Finally, students chose one side of the argument and participated in a debate of the issues. This was a structured Teacher-Directed Inquiry as the teacher provided the inquiry prompts and prescribed the process, but students generated their own solution based on evidence and data (Herron, 1971).

Students also participated in a long-term Capstone project beginning in February and extending through June. Students worked on this project both in and out of class. Students received Teacher-Directed Inquiry instruction on this project for an average of two 40-minute periods per week. The time spent in the treatment was comparable between both groups. The project was a group-based research project and presentation that focused on an exploration of issues facing contemporary American or global society. Roles were assigned to the students such as Research Paper Editor who was in charge of organization and final edits, Research Director who organized the research process and coordinated with the media

center, Creative Director in charge of the art, and Time Keeper to ensure deadlines were met. The teacher guided the class through each stage of this project by providing templates to delineate the process students were to follow.

Students were not formally taught the creative problem solving techniques of brainstorming, or problem finding, nor did they engage in the language of creativity and critical thinking. Although students had templates presented as brainstorming, the rules of brainstorming were not observed. Brainstorming has critical components that include: suspending judgment, numerous possibilities, merging of ideas, and novel thinking (Isaksen & Treffinger, 1985). In the Teacher-Directed Inquiry group, the template for brainstorming limited the quantity of responses and also instructed students to seek out possible ideas from a resource, rather than their own creative thinking. The template also incorporated a critical thinking element. This could impact students' ability to suspend judgment while brainstorming because the inclusion of the analysis of ideas during the divergent thinking phase requires students to evaluate ideas and make assessments. This impacts brainstorming as it may lead to premature elimination of ideas that seem to be unattainable or unrealistic. Often these ideas can be cultivated and developed to become novel and creative ideas when suspended judgment is in effect.

Working in teams, students collaborated to identify a problem. They then developed essential questions, designed and executed a research plan. Their research plan included inquiry elements such as generating lists of questions that needed to be answered in order to obtain the information to answer the essential question. Students also created questions to ask in a primary source interview. Teacher instruction was given on conducting research utilizing a variety of sources including books, periodicals, electronic sources, and

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interviews. Students conducted a formal presentation to share their findings. Students completed a self-reflection template to evaluate their strengths and weaknesses during this learning experience.

All students who participated in the Teacher-Directed Inquiry group were entered into a drawing for a technology related gift card raffle for participation at the completion of the study.

Summary of Treatments

Both the Student-Directed Inquiry group and the Teacher-Directed Inquiry group utilized inquiry strategies to teach similar social studies units. Both groups were taught the necessary processes to successfully access and learn the curriculum and apply higher order thinking skills such as analysis, synthesis, and evaluation. They also investigated issues from multiple perspectives, which is a vital 21st Century skill (Wagner, 2008). Both groups engaged in self-reflective practice as well.

The Student-Directed Inquiry group utilized a PBSL to independently apply the CPS process. Through a Type II mini-course in social studies, students were taught how to apply the necessary convergent and divergent thinking skills such as brainstorming, asking questions, performing a critical analysis to determine importance of ideas, honing research skills, synthesizing ideas, and evaluating possible solutions leading to solving the problem at hand with a unique and creative answer. Ultimately, the Student-Directed Inquiry group was able to apply their knowledge of the CPS process through a PBSL project, facilitated by an advisor.

The Teacher-Directed Inquiry group, learned many similar skills. They learned to develop questions, develop research skills, analyze data, and synthesize information to

create a project. Students were guided through the application of each skill throughout their inquiry projects within the social studies class. Students did not participate in service learning, nor did they have an opportunity to direct their own inquiry.

Data Collection Procedure and Timeline

Overview

This study was organized in the fall of 2010, but did not commence until after permissions were collected. There were comparable amounts of instruction, yet slightly varied start and end dates at the different sites. This was due to the availability of the subjects at each of the sites.

The CM3 pretest was given on March 1, 2011 at the site where students engaged in the Student-Directed Inquiry. This researcher would have preferred to collect data earlier, however, due to the excessive amount of snow days, the permissions were not able to be collected in a timely manner. These students engaged in two units of study for three weeks each during the treatment. Students engaged in thirty 40-minute social studies periods for 6 weeks, and five 40-minute advisory periods for a total of approximately 23 hours of total treatment time. Students at this site took the CM3 posttest and the CRS on May 23, 2011. This researcher utilized the fall and winter to introduce the concept of PBSL to students and teachers, train social studies and advisory teachers in the Student-Directed Inquiry group, and collect permissions.

The CM3 pretest was given at the Teacher-Directed Inquiry site on November 23, 2010. This was the only time the pretest data could be collected at this site. Students at this site engaged in 21 social studies periods of 40 minutes each, where they engaged in the Capstone project, or other Teacher-Directed Inquiry lessons for a total of 14 hours of

treatment time. Students at this site took the CM3 posttest on April 6, 2011. These students continued to participate in lessons from the Capstone project for 11 more sessions, plus three more Teacher-Directed Inquiry lessons totaling approximately nine more hours of engagement for a final number of 23 total hours in the treatment. The students in the Teacher-Directed Inquiry group took the CRS on May 26, 2011.

Preliminary Information

In the fall, the researcher sought permission to conduct the study at both the sites. All administrators granted permission to conduct the study.

Site 1: Student-Directed Inquiry. In September, members of the Building Leadership Team for one of the schools involved with this study agreed to participate in a service learning project. A definition of service learning was agreed upon which included a curriculum connection to a community service project. A parent in the school was the founder of the Afya organization (Afya, 2007). The school partnered with the Afya organization for the purpose of the service learning project.

In the early part of the year, students were assigned advisory groups. There were approximately nine students assigned to each of 14 advisory groups. Not all of these students became participants in the study. Within these groups, students met once a week for the first half of the school year. Students participated in a variety of team-building activities throughout September. This created a safe atmosphere for students where there was an expectation of mutual respect. This environment was beneficial for brainstorming as all ideas are accepted in proper brainstorming activity and judgment is suspended.

In October, advisors and social studies teachers were given one hour of professional development to introduce service learning and the project, and gain an introductory

overview to the creative problem solving method. The researcher presented the information in an afterschool meeting.

In preparation for the study, the students utilized one of their advisory meetings to view a presentation by Afya. At this time, students were given a project overview. A slideshow presentation was delivered to show the devastation in Haiti and the poverty in Tanzania. Students were asked to select which country they preferred as a focus for their service. Students selected Tanzania.

In November, teachers were given a presentation and a script about the educational environment in Tanzania. Students viewed the presentation over two advisory periods to get a sense of the degree of poverty and lack of resources for students in Tanzania. To engage students, discussions followed the slideshow.

Site 2: Teacher-Directed Inquiry. During the fall semester, students became part of the Teacher-Directed Inquiry group at a site utilizing primarily traditional instructional methods. Instruction included reading from textbooks on topics such as the Declaration of Independence, answering questions, and completing projects such as writing a personal Declaration of Independence. Assessment of projects was done via rubric, and coupled with traditional tests and quizzes.

Teachers were not trained in the inquiry model by the researcher. However, an article on Project-Based Learning authored by this researcher was influential in creating the Capstone project implemented later in the year (Bell, 2010).

Permissions and Professional Development

During the month of January, parental consent and assent forms were disseminated at both sites. Student permissions were collected in February. This took longer than anticipated, as there were a record number of snow days and a mid-winter recess.

Site 1: Student-Directed Inquiry. Social Studies teachers and advisors at the Student-Directed Inquiry agreed to participate in the study. Social studies teachers received one hour of professional development detailing the creative problem solving method. Each stage was specifically taught including; mess finding, fact finding, problem finding, idea finding, solution finding, and acceptance finding (Isaksen & Treffinger, 1985). Vocabulary related to the creative problem solving method was introduced as well. Curriculum was discussed that included ways to teach creative problem solving and incorporate the problem-based technique.

In advisory groups, Type I preliminary activities began prior to the commencement of the study to enable the students to gain familiarity with and generate interest in Tanzania. Students completed a chart about Tanzania that informed the advisors about what they knew about Tanzania and what they wanted to know. Students and advisors then engaged students in multiple discussions based on the following questions:

1. What do you know about the life and education of the children of Tanzania?

2. What questions would you ask a student in Tanzania to understand his/her life better?

3. How can you get involved and help?

4. Is there a particular area of interest that you would like to focus on for your service project?

In January, advisors received one hour of professional development on how to facilitate the service project utilizing the creative problem solving method. This training also included the definition of brainstorming and dissemination of materials for Type I experiences. Materials included books about children in Tanzania written by Tanzanian authors, and a teacher handbook with information, lessons, games, and activities for creative and critical thinking was distributed along with a student booklet to ensure continuity between advisory groups. Lessons were reviewed at this session.

Social studies teachers also received a second hour of professional development to review the creative problem solving method, the language of creativity, and brainstorming techniques. Units of study that incorporated these processes were finalized. The two social studies teachers also served as advisors, in addition to 12 other teachers who were advisors.

By mid-winter, advisory teachers were emailed the upcoming preliminary lessons as reminders and given an opportunity for additional support and individual training. Teachers communicated with the researcher in person or via email for questions or clarifications.

In advisory, preparation for the Student-Directed Inquiry occurred as students received their student handbooks. The handbooks provided additional information about Tanzania and graphic organizers and templates for problem solving. The handbook also provided students with the problem solving task they would undertake which was to help supply a school in Tanzania with educational resources. The handbook charged students with this task and assigned them the role of a humanitarian. To familiarize students with Tanzania, students engaged in two Type I introductory experiences. In the first experience, students read fictional stories of children in Tanzania, and had an open discussion based on the rights of a child. In lesson two, students reviewed the rights of a child focusing on the

right to an education. Students then took a "looking walk" around their school to identify what materials they had in their school to support their education. They then analyzed which materials were items that were wanted and which ones were needed to support students' education.

Site 2: Teacher-Directed Inquiry. The social studies teacher in the Teacher-Directed Inquiry group agreed to participate in the study. Students at this site took the CM3 pretest on November 23, 2010. Throughout the fall, students in the Teacher-Directed Inquiry group were engaged in traditional social studies instruction as well as bi-weekly current event debates of related issues. Students did not participate in a service learning project.

In January, teachers introduced students to the Capstone project. Students were charged with developing a position on a critical issue that faces us in the 21st Century. In February the first lesson was delivered. Individual students were given publications to review to identify a topic of interest. Then, students shared their topics as a group, selected a group topic, and then sought approval of their topic from the teacher as a checkpoint prior to proceeding onto the next lesson. Students in the groups were assigned roles and informed of their responsibilities. In the second lesson, students were given a teacher-directed lesson on how to form an essential question. Groups developed essential questions for their topics. They then completed a graphic organizer from which they determined what information they would need to answer their question. Students did not receive instruction on brainstorming techniques.

Research Study

    Research study status. The research study commenced on March 1, 2011 for the Student-Directed Inquiry group. On this date, social studies teachers administered the California Measure of Mental Motivation (CM3) pretest to all student participants at their site. The study began on November 23 for the Teacher-Directed Inquiry group as this is when they were administered the CM3. The treatments commenced after the pretests were administered. For detailed information regarding the timeline of the treatments see Appendix A.

Culmination of the Study

    All students who completed the study took the CM3 posttest. The Student-Directed Inquiry group students who completed a PBSL project, $n = 29$, took the CM3 posttest and the CRS on May 23, 2011. In the Teacher-Directed Inquiry group, $n = 32$, students took the CM3 posttest on April 7, 2011 and the CRS on May 26, 2011. Students who completed the study were entered into a raffle for the technology related gift cards. One student from each group won a gift card.

CHAPTER FOUR:

ANALYSIS OF THE DATA AND AN EXPLANATION OF THE FINDINGS

Chapter Overview

In this study the outcomes of the effects of a Student-Directed Inquiry approach utilizing problem-based service learning, are compared to a Teacher-Directed Inquiry model that did not utilize problem-based service learning. The research was based on eighth graders' motivation to apply creative problem solving and critical thinking, as well as students' sense of civic responsibility. Three major research questions were addressed.

The research addressed the following questions:

1. Is there a significant difference in students' motivation to use creative problem-solving and critical thinking skills between eighth grade students who were engaged in a Student-Directed Inquiry using a PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in a social studies class?

2. Is there a significant difference in students' sense of civic responsibility between eighth grade students who were engaged in a Student-Directed Inquiry using a PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in a social studies class?

3. To what degree and in what manner do group membership in a Student-Directed Inquiry utilizing a PBSL or a Teacher-Directed Inquiry, and students' motivation to use creative problem-solving and critical thinking skills, predict civic responsibility?

First, procedures for code and value cleaning as well as an inspection of outliers are presented. Then the descriptive statistics, analysis, and results for each research question are reported.

Code and Value Cleaning

The initial data screening process addressed the issue of coding and value cleaning. Once the data were collected, numerical codes were checked for each value in the study to ensure that they were legitimate and reasonable for each unit of analysis (Meyers, Gamst, & Guarino, 2006). This code cleaning procedure ensures that all data are within a specific range particular to the variable.

The initial screening took place when all data were collected and commenced with a simple visual inspection. The data sets were examined for missing values. The Student-Directed Inquiry group had missing data for 19 cases. This was a result of students who withdrew from the study and therefore the researcher did not collect posttest data from these students. This study was a voluntary activity and there were no grades to be awarded for participation. The students who withdrew did not wish to complete Type III activities on a voluntary basis. These 19 cases were excluded from the study. The total number of students who continued in the study represents a 66% completion rate for the service projects. Under this method of listwise deletion, a single missing value in a single variable leads to the elimination of that case from the statistical analysis leaving the Student-Directed Inquiry group at $n = 29$ participants (Meyers et al., 2006). The visual inspection also identified one case that had a substantially different Civic Responsibility Survey (CRS) score than the rest of the cases. This was checked against the original instrument's answer key and found to be accurate, but would surely be an outlier due to the extremely low score

of 3 out of a possible 50. This case was also eliminated in a listwise deletion resulting in a total of *n* = 28 for the Student-Directed Inquiry group. The Teacher-Directed Inquiry group had only one case missing reducing the sample size minimally *(n* = 32). SPSS statistical software (2009) was used to analyze the data.

Univariate and Multivariate Outliers

      Univariate outliers. Descriptive statistics were examined for the data. To check for normality, acceptable measures of skewness and kurtosis were examined. Skewness, which measures the symmetry of a distribution and kurtosis, the clustering of scores toward the center of a distribution are considered within acceptable limits in the ±1.00 range (Meyers et al., 2006). All dependent variables were within the acceptable range for skewness and kurtosis on the California Measure of Mental Motivation (CM3) pretest. See Table 5 for means and standard deviations of the pretest scores.

      The descriptive statistics for the CRS can also be found in Table 5. Skewness and kurtosis were within the normal bounds.

      The skewness (+1.397) and kurtosis (+4.153) for the CM3 posttest data for the Creative Problem Solving scale in the Student-Directed Inquiry group was outside normal limits. The box plot further indicated case 17 was the outlier greater than three standard deviations from the mean (*M* = 28.75, *SD* = 5.268).

Table 5

Descriptive Statistics for CM3 Pretest and CM3 Posttest Data

CM3 Scale	Pretest				Posttest			
	Mean	SD	Skewness	Kurtosis	Mean	SD	Skewness	Kurtosis
Mental Focus								
Student-Directed Inquiry	28.82	8.296	.178	.145	26.25	4.934	-.078	-.290
Teacher-Directed Inquiry	31.31	8.055	-.875	1.017	32.06	7.837	-.003	-.531
Learning Orientation								
Student-Directed Inquiry	30.25	9.610	-.275	.295	28.89	7.613	.355	.207
Teacher-Directed Inquiry	31.41	8.758	-.025	-.784	34.44	7.632	.230	-.784
Creative Problem Solving								
Student-Directed Inquiry	29.57	7.426	.028	-.018	28.75	5.268	1.397	4.153
Teacher-Directed Inquiry	30.72	7.587	-.368	-.571	31.38	8.961	.112	-.668
Cognitive Integrity								
Student-Directed Inquiry	31.61	8.297	-.555	-.473	28.75	8.159	.307	.688
Teacher-Directed Inquiry	32.66	7.990	.101	-.914	33.41	8.534	-.502	.196

Table 5 (Continued)

Descriptive Statistics for CM3 Pretest and CM3 Posttest Data

CM3 Scale	Pretest				Posttest			
	Mean	SD	Skewness	Kurtosis	Mean	SD	Skewness	Kurtosis
Scholarly Rigor								
Student-Directed Inquiry	27.64	5.506	-.398	-.677	25.50	5.699	-.425	.876
Teacher-Directed Inquiry	28.09	5.561	-.493	-.262	29.28	7.172	.467	.163

To examine the out-of-range skewness and kurtosis values, Stevens (2002) recommends that for small sample sizes of 10 – 50 the Shapiro-Wilk test of normality detects extreme departures from normality. By combining the skewness and kurtosis coefficients to produce one value, the Shapiro-Wilk test is the most powerful test to establish normality. Meyers et. al (2006) recommend .01 as an appropriately stringent alpha level for small sample sizes. See Table 6 for the Shapiro-Wilk test results for the Student-Directed Inquiry Posttest of the Creative Problem Solving scale, which indicates that the results are adequate at the $p < .01$ level indicating a normal distribution. At this point, the univariate data were considered clean and ready for analysis.

Table 6

Shapiro-Wilk Test of Normality

Student-Directed Inquiry Group	Shapiro-Wilk		
	Statistic	df	Sig.
CM3 Posttest Creative Problem Solving	.879	28	.004

Multivariate outliers. The Mahalanobis distance was calculated in order to check for multivariate outliers. According to the box plot below and the accompanying table, there are two variables that appear to be outliers, case 17 and case 9. These extreme cases are identified by exceeding the Chi-square value of 16 with 6 degrees of freedom (Meyers et al., 2006).

Table 7

Mahalanobis Distance

			Case Number	Chi Square
Mahalanobis Distance	Highest	1	17	18.52573
		2	9	16.06777
		3	7	13.28699
		4	18	12.89653
		5	8	12.71411
	Lowest	1	5	1.43379
		2	42	1.53584
		3	39	1.55548
		4	32	1.61708
		5	1	1.72653

However, these extreme cases are from the Student Directed Inquiry group and are related to high scores. To eliminate them would have decreased the already small sample size and produced unequal variances. Therefore, these cases were retained in the sample. The Student-Directed Inquiry group had a final sample size of $n = 28$ and the Teacher-Directed Inquiry group had a final sample size of $n = 32$.

Analysis of the Data

Results of Research Question 1

Is there a significant difference in students' motivation to use creative problem-solving and critical thinking skills between eighth grade students who were engaged in a Student-

Directed Inquiry using a PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in social studies classes?

Nondirectional hypothesis 1. There will be a significant difference in students' motivation to use creative problem-solving and critical thinking skills between eighth grade students who were engaged in a student directed inquiry using a PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in a social studies class.

Assumptions for CM3 pretest. The assumption of normality was met by the analysis of skewness and kurtosis. All pretest data of skewness and kurtosis were within normal bounds.

To further investigate the assumption of equal variance between groups by the pretest data, the researcher continued the analysis of the pretest scores for the CM3. A multivariate Analysis of Variance (MANOVA) procedure was conducted to examine the differences between the Student-Directed Inquiry group and the Teacher-Directed Inquiry group with respect to students' motivation to use critical thinking skills and creative problem solving skills, between groups. Table 7 indicates that according to the Box M, covariances were equal across groups indicating homoscedasticity. There were equal levels of variability observed by a significant value of $p = .267$, $(p < .05)$.

Table 8

Box's Test of Equality of Covariance Matrices for CM3 Prettest

Box's M	19.776
F	1.195
df1	15.000
df2	13010.509
Sig.	.267

The assumption of independence was addressed through the quasi-experimental pre/posttest design (Meyers et al., 2006). The participants could not be randomly sampled and selected for each group as they were from two schools that were in separate towns in different states. The sample was selected from two unrelated groups and this adds to the assumption of independence.

To test for differences between the two groups prior to the commencement of the study, a Multivariate Analysis of Variance (MANOVA) of pre-test data on the CM3 was calculated. A MANOVA measures the effect of one or more independent variables on two or more quantitative dependent variables (Meyers et al., 2006). The independent variable in this research question was assignment to group, either Student-Directed Inquiry or Teacher-Directed Inquiry. There were five dependent variables: Mental Focus, Learning Orientation, Creative Problem Solving, Cognitive Integrity, and Scholarly Rigor. The Wilks' Lambda for pretest data on the CM3 showed no significant difference between groups ($F(2,56) = .364$, $p = .871$, partial $\eta^2 = .033$). This suggests that students in the Student-Directed Inquiry group and the Teacher-Directed Inquiry group had equal motivation to use critical thinking and creative problem solving skills prior to the commencement of the study.

Table 9

Wilks' Lambda for CM3 Pretest

	Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta
Intercept	Wilks' Lambda	.031	336.635	5.000	54.000	.000	.969
Group	Wilks' Lambda	.967	.364	5.000	54.000	.871	.033

Assumptions for CM3 posttest. The assumptions of the CM3 posttest were examined. The assumption of normality was met after the Shapiro-Wilk test was applied to the Creative Problem Solving scale for the Student-Directed Inquiry group. The assumption of equal variances was checked by the analysis of the Box M. The significance of the Box M indicates that homoscedasticity had been violated. As previously noted, normality was determined by the Shapiro-Wilk test and the analysis was continued (Stevens, 2002).

Table 10

Box's Test of Equality of Covariance Matrices for CM3 Posttest

Box's M	51.734
F	3.126
df1	15.000
df2	13010.509
Sig.	.000

The assumption of independence was established previously with regard to the participants in this quasi-experimental study being selected from two different sites. The Baretlett's Test of Sphericity indicated that the dependent variables were sufficiently correlated to proceed with the analysis.

Table 11

Bartlett's Test of Sphericity

Likelihood Ratio	.000
Approx. Chi-Square	110.907
df	14.000
Sig.	.000

As reported in Chapter 3, a Bonferroni adjustment will be used to analyze the multivariate tests at $p \leq .017$. This level was set at this more stringent level to account for the multiple uses of the data.

The Levene's test further indicated that there was an inequality of variances [$F(1,58)$ = 7.325, $p < .017$] in the Creative Problem Solving subscale, which is in direct relation to the retention of the outliers on this scale.

Table 12

Levene's Test of Equality of Error Variances

CM3 Posttest	F	df1	df2	Sig.
Mental Focus	5.631	1	58	.021
Learning Orientation	.189	1	58	.665
Creative Problem Solving	7.325	1	58	.009
Cognitive Integrity	.001	1	58	.973
Scholarly Rigor	2.069	1	58	.156

MANOVA analysis. The multivariate test revealed that there was significance ($F(5, 54) = .31$, $p = .017$) between groups at the $p \leq .017$ level. The partial eta indicated that approximately 22% of the variance in the dependent variables was due to group. These results indicated that there was a statistical difference in students' motivation to use creative problem solving and critical thinking between the Student-Directed Inquiry group and the Teacher-Directed Inquiry group after the treatments were administered and completed.

Table 13

Multivariate Tests for CM3 Posttest

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Wilks' Lambda	.031	337.479[a]	5.000	54.000	.000	.969
Group	Wilks' Lambda	.780	3.055[a]	5.000	54.000	.017	.220

The Test of Between Subjects Effects (Table 14) denotes that the statistically significant differences between groups were on the Mental Focus and Learning Orientation scales. The Teacher-Directed Inquiry group ($M = 32.06$, $M = 34.44$) scored significantly higher than the Student-Directed Inquiry group ($M = 26.25$, $M = 28.89$) on the Mental Focus scale and the Learning Orientation scale, respectively. The mean scores for the Teacher-Directed Inquiry group reflect that as a group, these students are "somewhat disposed" (Giancarlo, 2010, p. 27) toward the attributes, based on the fact that their scores fell within the range of 31 - 40. The Student-Directed Inquiry group's mean scores indicate that these students as a group are in the "ambivalent" (Giancarlo, 2010, p. 27) range (scores from 20 – 30), having a neutral disposition toward the attributes. These means are not only statistically different, but are categorically different based on the guidelines for interpreting the results of the CM3. See Table 5 for further information regarding descriptive statistical data.

Table 14

Test of Between Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Scale	Mental Focus	504.525	1	504.525	11.426	.001	.165
	Learning Orientation	459.096	1	459.096	7.900	.007	.120
	Creative Problem Solving	102.900	1	102.900	1.843	.180	.031
	Cognitive Integrity	323.765	1	323.765	4.631	.036	.074
	Scholarly Rigor	213.515	1	213.515	5.011	.029	.080

Results of Research Question 2

Is there a significant difference in students' sense of civic responsibility between eighth grade students who were engaged in a Student-Directed Inquiry using a PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in a social studies class?

Nondirectional hypothesis 2. There will be a significant difference in students' sense of civic responsibility between eighth grade students who were engaged in a Student-Directed Inquiry using PBSL project and those who were engaged in a Teacher-Directed Inquiry approach in a social studies class.

An Analysis of Variance (ANOVA) was conducted using SPSS to analyze the posttest results regarding the differences between the two treatment groups for the

dependent variable, civic responsibility. In Table 15, the mean posttest scores for the

Student-Directed Inquiry Group and the Teacher-Directed Inquiry Group are presented.

Table 15

Descriptive Statistics for Civic Responsibility Survey

	Mean	SD	Skewness	Kurtosis
Student-Directed Inquiry	32.75	6.735	-.430	.397
Teacher-Directed Inquiry	34.81	7.222	-.291	-.611

Assumptions. Skewness and kurtosis are within normal limits of $\pm$ 1. This indicates

that the assumption of normality has been met. Analysis of the homogeneity of variances

was established by the Levene's Test in Table 16. The results indicated that variances were

equivalent (p = .53). The assumption of independence has also been met as previously

noted the sample was selected for this quasi-experimental study from two unrelated sites in

separate school districts.

Table 16

Levene's Test of Equality of Error Variances for CRS

Values			
F	df1	df2	Sig.
.398	1	58	.530

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ANOVA analysis. Table 16 indicates that the mean CRS scores for the Student-Directed Inquiry group and the Teacher-Directed Inquiry group were not statistically different ($F(1,58) = 1.53$, $p = .22$).

Table 17

Tests of Between-Subjects Effects for the CRS Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Group	75.001	1	75.001	1.531	.221	.026

Results of Research Question 3

To what degree and in what manner did group membership and students' motivation to use creative problem-solving and critical thinking skills predict civic responsibility?

Nondirectional hypothesis 3. Civic responsibility will be predicted by the set of variables including group membership and students' motivation to use creative problem-solving and critical thinking skills (Mental Focus, Learning Orientation, Cognitive Integrity, and Scholarly Rigor).

A Multiple Linear Regression was analyzed to determine the degree to which the variables of assignment to group, mental focus, learning orientation, creative problem solving, cognitive integrity, and scholarly rigor predicted students' sense of civic responsibility. A standard regression method was implemented. This analysis entered all variables into the equation simultaneously. The multiple regression analysis indicated which variables, are the most significant predictors of civic responsibility.

Assumptions. The data were examined to establish that the assumptions underlying the significance test for the multiple correlation coefficient were met. First, the statistical tests of normality were analyzed. This assumption was met by examining the skewness and kurtosis values for all variables. Two values exceeded the ±1 value, the skewness (1.397) and kurtosis (4.153) for the Student-Directed Inquiry group on the Creative Problem Solving scale on the CM3 posttest. Therefore, this was followed by Shapiro-Wilk test, which indicated that the data were within normal bounds (Stevens, 2002). Mahalanobis distances were calculated to test for multivariate normality. Two cases exceeded the critical value of 16, (18.52573, 16.06777). However, to remove these cases that were related to high scores would have reduced the already small sample size and were retained in the sample (Tabachnick & Fidell, 1989).

Collinearity or multicollinearity, when two or more variables are highly correlated, must be ruled out in order to ensure the integrity of the regression. This was explored through a correlation matrix as seen in Table 17. The correlations between variables indicated small to moderate correlations as presented by values of .160 to .683. Meyers et al. (2006) notes, "As a general rule of thumb, we recommend that two variables correlated in the middle .7s or higher should probably not be used together in a regression" (p. 181). As noted in the table, all variables are correlated below the .7 level, and are in the low to moderate range. Multicollinearity was further examined by looking at the Collinearity Statistics of Tolerance parameters and the Variance Inflation Factor (VIF) in Table 18. The Tolerance rejects factors that are too highly correlated by identifying the amount of the variance of each predictor that is not accounted for by other variables. Multicollinearity is indicated for a variable if the tolerance number is .01 or less (Meyers et al., 2006). Similarly, the VIF

measures multicolliniarity at levels of 10 or greater. The data are considered not to display

evidence of multicollinearity as the levels are within these guidelines. In addition, the

assumption of independence has been established.

Table 18

Correlations between CRS and group assignment and the scales of the CM3

	CRS	Group	Mental Focus	Learning Orientation	Creative Problem Solving	Cognitive Integrity	Scholarly Rigor
CRS		.160	.407***	.432***	.336**	.480***	.436***
Group			.406***	.346**	.175	.272	.282*
Mental Focus				.524***	.550***	.412***	.549***
Learning Orientation					.673***	.413***	.683***
Creative Problem Solving						.214	.648***
Cognitive Integrity							.373**
Scholarly Rigor							

Note: * $p \leq .017$, ** $p \leq .01$, ***$p \leq 001$

Table 19

Coefficients Table for CM3 Posttest

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		Collinearity Statistics	
	B	Std. Error	Beta			Partial	Part	Tolerance	VIF
(Constant)	14.530	4.268		3.405	.001				
Group	-1.106	1.777	-.079	-.623	.536	-.085	-.070	.780	1.283
Mental Focus	.137	.151	.141	.912	.366	.124	.102	.528	1.892
Learning Orientation	.119	.157	.136	.758	.452	.104	.085	.391	2.555
Creative Problem Solving	.006	.162	.006	.037	.971	.005	.004	.420	2.378
Cognitive Integrity	.265	.107	.325	2.484	.016	.323	.279	.736	1.359
Scholarly Rigor	.169	.177	.162	.955	.344	.130	.107	.438	2.285

Multiple linear regression analysis. A standard multiple linear regression analysis was selected to determine the effect of the independent variables as a set. The model summary depicted in Table 19, indicates the degree to which group assignment and the five scales of the CM3, Mental Focus, Learning Orientation, Creative Problem Solving, Cognitive Integrity, and Scholarly Rigor, were successful at predicting the dependent variable students' sense of civic responsibility. As noted in Table 20, R was .576. R^2 (.332) is used as a more conservative measure of the amount of variance the independent variables accounted for on the dependent variables, when sample sizes are small. The R^2 indicated that 33.2% of the variance of the CRS scores was accounted for by assignment to group, mental focus, learning orientation, creative problem solving, cognitive integrity, and scholarly rigor. Further analysis of the data tables provide information regarding the degree to which each predictor variable contributed to students' sense of civic responsibility.

Table 20

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.576	.332	.256	6.063	.332	4.392	6	53	.001

Upon examination of the coefficients on the regression analysis summary (Table 18), the importance of each variable in the analysis is established. The beta weights are a standardized measure based on mean scores. The beta weights indicate that Cognitive Integrity (beta = .325) is the strongest predictor of students' sense of civic responsibility and is statistically significant ($p < .017$). Assignment to group (beta = -.079) had a negative effect on students' sense of civic responsibility. This indicates that assignment to the Student-Directed Inquiry group could slightly lower a students' sense of civic responsibility, while assignment to the Teacher-Directed Inquiry group could slightly raise a students' sense of civic responsibility. Creative Problem Solving (beta = .006) was the weakest predictor of students' sense of civic responsibility. The strongest predictor, Cognitive Integrity, accounted for .078 or 7.8% of the variance explained by the predictors.

Summary

The analysis presented in this chapter explored the effects of students' participation in either a Student-Directed Inquiry group utilizing a PBSL or a Teacher-Directed Inquiry group related to students' motivation to use critical thinking and creative problem solving skills, and students' sense of civic responsibility as guided by the three research questions. Question one sought to determine, through a MANOVA, if there was a difference in motivation to use critical thinking skills and creative problem solving skills between students in either group at the $p \leq$ .017 level. Results indicated a significant difference on two scales, mental focus and cognitive integrity. Therefore, the null hypothesis was thus rejected. Students who participated in the Teacher-Directed Inquiry group had significantly higher Mental Focus and Cognitive Integrity scores than students in the Student-Directed Inquiry group.

Question two examined the differences between group assignment and students' sense of civic responsibility. A posttest only ANOVA for the full sample ($n = 60$) was employed. The results indicated that there was no significant difference in civic responsibility between those participating in the Student Directed Inquiry group, which utilized a problem-based service learning approach, and the Teacher-Directed inquiry group. In this case, the null hypothesis was accepted.

In question three a Multiple Regression procedure was used to predict civic responsibility using the following set of predictors: group assignment (Student-Directed Inquiry group and the Teacher Directed Inquiry group) and student's motivation to utilize critical thinking and creative problem-solving skills (Mental Focus, Learning Orientation, Creative Problem-Solving, Cognitive Integrity, and Scholarly Rigor). The stringent level of $p \le .017$ was observed through a standard Multiple Regression Analysis indicating that the independent variables were significant predictors of the dependent variable. The analysis also revealed the extent to which each variable, independent of the others, contributed to the variance and the degree of predictive strength. The students' motivation to use critical thinking and creative problem-solving skills had a positive correlation and positive influence on students' sense of civic responsibility. The most evident predictor was Cognitive Integrity. The implications of the findings will be discussed more thoroughly in Chapter Five.

CHAPTER FIVE:

SUMMARY AND RECOMMENDATIONS

Chapter Overview

The six sections of Chapter Five provide a summary of the study and is comprised of an elaboration of the results, a comparison of the findings to the literature, the limitations of the study, and educational and research implications. The summary gives an overview of the entire study. Within the findings section, the statistical analyses of the Student-Directed Inquiry group that utilized a PBSL and the Teacher-Directed Inquiry group are reviewed with regard to the literature review that supports or refutes findings. The limitations section provides a review of the limitations that were revealed during the study. This research led to multiple ideas for educational implementations and future research, which are discussed in the final sections of this chapter.

Summary of Study

The purpose of this study was to contribute to the greater body of research on inquiry as an approach to instruction and service learning. The value of critical thinking, creative problem solving, and civic responsibility in students is pervasive in educational discourse (Terry, Bohnenberger, Renzulli, Cramond, & Sick, 2008; Wagner, 2008). Teachers recognize that inquiry methods can lead students to achieve these desired outcomes (National Council for the Social Studies, 1994). However, in practice, the implementation of inquiry teaching is at its inception (Sormunen, 2008). This is partially due to the lack of experience teachers have with this methodology. Jeanpierre (2006) noted that teachers value inquiry, especially student-directed inquiry. However, while teachers strive to implement full inquiry in their classrooms, they more often implement teacher-directed inquiry (Jeanpierre, Oberhauser, & Freeman, 2005).

Another factor that impedes widespread implementation is teachers' perceptions of inquiry being a supplement to required content, rather than a teaching approach (Jeanpierre, 2005). Jeanpierre et al. (2005) also recognized the challenge of developing teachers who are resistant to change as they "require restructured belief systems about valuable teaching and learning outcomes" (p. 687). The processes of assisting students to develop their own questions; designing experiments; collecting data; analyzing and interpreting data; and drawing and reporting conclusions are integral to open-inquiry. This researcher sought to investigate inquiry at two levels, Student-Directed Inquiry and Teacher-Directed Inquiry with regard to critical thinking, creative problem solving, and civic responsibility. Within the Student-Directed Inquiry group a problem-based service learning (PBSL) approach was implemented. The need for research on 21st century skills was the major impetus for this study.

John Dewey (1938b) touted the benefit of inquiry as a way to tap the intellectual facet of learning through the application of knowledge. Inquiry allows students to nurture their own curiosity, identify a problem to solve, and then utilize their creative and critical thinking skills to arrive at a viable solution. When students engage in these types of experiences, they become confident in their abilities to problem solve, and in turn, to seek out more complex problems to conquer. John Dewey (1938b) called this a pattern of inquiry.

Twenty-first century skills include multiple components: "critical thinking and problem solving, collaboration across networks and leading by influence, agility and adaptability, initiative and entrepreneurialism, effective oral and written communication, accessing and analyzing information, and curiosity and imagination" (Wagner, 2008, p. 67). These skills are all addressed through inquiry instruction. For this study, the Creative Problem Solving (CPS) Method (Isakson & Treffinger, 1985) was the framework for a Student-Directed Inquiry group to

utilize a problem-based service learning approach during social studies instruction as well as advisory periods. Students in the Student-Directed Inquiry group learned the processes of CPS in social studies class through two units of study. Students applied the CPS process to identify a service learning issue, created inquiry questions, then brainstormed possible solutions. They critically analyzed the viability of solutions, selected the best solution, and implemented their service project to help students in a selected location. In this case, a service learning program in Tanzania was the site for the project. This activity was guided by the students and facilitated by advisors. Students also kept a reflection journal about their thoughts of their own creative processes. Students in the Teacher-Directed Inquiry group did not complete a service learning project, but did utilize a teacher-supported method of inquiry in their social studies class, according to Herron's Levels of Inquiry model (1971). For this group, the teacher provided the guiding questions and materials, and the students worked collaboratively to complete predetermined projects. This researcher sought to reveal the effects of the treatments with regard to students' motivation to utilize critical thinking and creative problem-solving skills, and their sense of civic responsibility.

Findings

This quasi-experimental study employed a sample of convenience *(n = 60)* of eighth grade students from two similar school districts. Data were collected through the use of two instruments, the California Test of Mental Motivation III+ (Giancarlo, 2010) and the Civic Responsibility Survey (Furco et. al, 1998).

Research question 1. A MANOVA was analyzed to identify if there were differences between the Student-Directed Inquiry group and the Teacher-Directed Inquiry group in their critical thinking skills and creative problem solving skills as measured by the CM3 (Giancarlo,

2010). The dependent variables included Mental Focus, Learning Orientation, Creative

Problem-Solving, Cognitive Integrity and Scholarly Rigor, scales of the CM3.

Pre and posttests were administered to each group. No significant differences were found

between groups on the pretest. Significant differences ($F(5, 54) = .31, p = .017$) were found on

posttest scores between the Student-Directed Inquiry and the Teacher-Directed Inquiry on two

scales, Mental Focus and Learning Orientation, at the $p \leq .017$ level. For Mental Focus, the

Teacher-Directed Inquiry group had a mean of 32.06 ($SD = 7.837$), while the Student-Directed

Inquiry group had a mean of 26.25 ($SD = 4.934$). When Learning Orientation was examined,

means were 34.44 ($SD = 7.623$) and 28.89 ($SD = 7.613$) for the Teacher-Directed Inquiry group

and the Student-Directed Inquiry group, respectively.

According to the authors of the CM3, students who score high on the Mental Focus scale

are diligent, focused, systematic, task-oriented, organized, and enjoy engaging in problem

solving. A student who has high mental focus enjoys complexity and does not get frustrated

when faced with a difficult or complex challenge (Giancarlo, 2010). These students are

methodical thinkers and have a comfort with decision-making. Students who score highly on the

Learning Orientation scale are intrinsically motivated to seek out knowledge. They have a desire

to learn and value the information gathering process as part of good decision-making (Giancarlo,

2010). The students in the Teacher-Directed Inquiry group possessed significantly higher

Mental Focus and Learning Orientation scores. This suggests that these students were more

disposed to problem solving and critical thinking than those students who were in the Student-

Directed Inquiry group.

An interesting note is that the mean CM3 posttest scores of the Student-Directed Inquiry

group were in the ambivalent range whereas the Teacher-Directed Inquiry group's mean CM3

posttest scores were in the somewhat disposed category on the scales of Mental Focus, Cognitive Integrity, Learning Orientation, and Creative Problem Solving. On the subscale of Scholarly Rigor, both groups' mean scores were in the ambivalent range. The students in the Teacher-Directed Inquiry group had higher mean posttest scores in all categories, and were more motivated to utilize their critical thinking and creative problem solving skills than the participants in the Student-Directed Inquiry group.

Research question 2. The second research question was answered utilizing a posttest only design. The Civic Responsibility Survey was a highly reactive measure, which may have encouraged students to respond to the questions with socially acceptable answers. Therefore, the posttest only design was employed to assess the difference in students' scores after participation in the treatments. No significant difference was found between groups with regard to their sense of civic responsibility when posttest scores were compared.

Research question 3. The third research question was used to examine the degree to which the independent variables of Mental Focus, Learning Orientation, Creative Problem-Solving, Cognitive Integrity, Scholarly Rigor, and group assignment, predicted the dependent variable, students' sense of civic responsibility. This question was analyzed with a Multiple Linear Regression procedure. The results indicated that the factors of group assignment and students' motivation to use critical thinking and creative problem solving skills, as a set, were significant predictors of students' sense of civic responsibility ($R^2 = .332, p < .017$). The factor with the strongest predictive strength and the only individual factor with significance was Cognitive Integrity, indicating that a high score on this scale was predictive of a higher sense of civic responsibility.

Comparison and Contrast of Findings

The review of the literature presented in Chapter Two gives merit to inquiry as an effective method of teaching students in terms of academic achievement, and increasing their motivation to use creative problem solving and critical thinking skills. The research supports this across academic disciplines and grade levels. Moreover, the National Research Council (1996) has endorsed inquiry as a key teaching strategy in science instruction. The literature also presented service learning as a problem-based approach to teach civic responsibility. However, there is still a dearth of research on inquiry acoss Herron's (1971) four levels.

Research question 1. Dewey (1938b) stated that, "the first result of evocation of inquiry is that the situation is taken, adjudged to be problematic. To see that a situation requires inquiry is the initial step in inquiry" (p. 107). These statements imply some degree of initiative that needs to be taken on the part of students to seek out problems and solve them. This idea was not fully supported by this research. Students in this study appeared to benefit from external teacher prompting and additional guidance to effectively engage in inquiry, in addition to their own intrinsic motivation.

Inquiry is not a new approach for teachers, however it is new to have national standards promote inquiry as a method of instruction across curricular areas (National Research Council; NRC, 2002; National Council for the Social Studies; NCSS, 2010). Both teachers and students may need more time and training to become acclimated to the expectations and to their new roles in an inquiry environment, especially in an open-inquiry context. Teacher training in inquiry methods is essential. Lack of adequate teacher training in inquiry methods is cited in Pine, Aschbacher, Roth, Jones, McPhee, Martin, Phelps, Kyle, & Foley (2006) as their study on developing inquiry strategies in 5th grade students showed no significant difference between

students who utilized hands-on inquiry methods and those who utilized textbooks for science instruction. Pine et al. (2006) stated that norm referenced tests are the standard measure of good instruction, however as our values in educational excellence shifts, so must our teaching methodologies, and in turn our teacher training, curriculum, and measurements of learning. Since inquiry can represent an extremely different method of teaching, teachers must have multiple experiences utilizing inquiry skills as a prerequisite to students' successful engagement with Student-Directed Inquiry. Sormunen (2008) also referenced the need for adequate teacher training in order for them to facilitate inquiry projects with students who had limited experience with problem solving due to limited procedural, declarative, or strategic knowledge. Scaffolding was noted as being critical to success. An element missing from the current study may have been sufficient teacher training.

Tuan et al. (2005) investigated inquiry in relation to learning styles and motivation. Their study compared guided-inquiry methods to traditional teaching methods. The guided-inquiry group showed significant gains in their motivation. Tuan asserted that guided-inquiry met student's needs for a specific level of authority required to complete a project. In the present research study, students in the Student-Directed Inquiry group kept reflection portfolios. The entries in the portfolios included statements indicating that students felt frustrated that they did not have clear directions and were unsure of what the teacher wanted them to do. Students are trained in our current education system to expect a didactic format of teaching and learning, inclusive of clear directions for educational outcomes. When expectations were open-ended, students in the Student-Directed Inquiry group struggled. The Teacher-Directed Inquiry group, however, had higher mean scores for motivation toward learning science. These students' need for authority were met with regard to adequate teacher support and guidance.

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Berg et al. (2003) acknowledged the frustration students felt when engaged in open-inquiry as compared to students who were engaged in guided-inquiry groups. In the current study, students in the Student-Directed Inquiry group noted their frustration in their reflection journals, but conclusions were difficult to draw as these journals were implemented to ensure program fidelity not program improvement. In practice, reflection journals and checkpoints can provide teachers with information to scaffold, avoid frustration, and overcome barriers in order to complete successful Type III experiences.

Delcourt (1994) identified five barriers to successful Type III projects: "lack of group or personal commitment; lack of interest in the topic; inadequate amount of time for working on the project; poor selection of human and material resources; inadequate information or skills prior to commencing an investigation" (p. 420). Several of these obstacles may have had some influence on the attitudes of students in the Student-Directed Inquiry group in this study. Renzulli's (1997) model indicates that Type I and Type II experiences support students in their Type III experiences. This study was structured to provide ample Type I and Type II experiences. However, checkpoints may have been beneficial to identify if additional Type I and II experiences were necessary. As noted by Delcourt (1994), this factor may have been an impediment in the present study. In addition, a lack of group or personal commitment greatly affects progress in completing a project. Students in the Student-Directed Inquiry group may not have had a deep commitment or the connection necessary to motivate them to take action and help students in Tanzania. Although students selected Tanzania as a focal point for their projects, Afya only offered a limited list of communities for their service learning activities. Students must have an interest in the topic in order to sustain focus and discipline in an independent project and work through any impending struggles or obstacles. Students were

given time in class to work on projects, however some time outside of class was required for project completion in this study. This additional time commitment may have been a problem for some students.

Sormunen (2008) examined open-ended inquiry in relation to fifth graders' problem solving ability. Sormunen (2008) reported that students who had limited prior experience with problem-solving needed teacher guidance and scaffolding to be successful. Berg et al. (2003) concurred by revising their open-inquiry to include greater teacher scaffolding to avoid student frustration that was discovered in their original open-inquiry design. Similar to the Student-Directed Inquiry group students, the students with low positive attitudes in Berg's study reported that they wanted clearer instructions in order to implement the processes and procedures of the inquiry. Therefore, the students in the Student-Directed Inquiry group in this study required more scaffolding to be successful, commensurate with their level of experience with inquiry.

Research question 2. Bandura (1997) theorized that successful experiences lead to higher levels of self-efficacy. In turn, a successful civic experience should serve to enhance students' sense of civic self-efficacy. In the present study, those in the Student-Directed Inquiry group who utilized a PBSL for the first time might not have had enough experience in PBSL to have established self-efficacy leading to a successful open-inquiry project or increased civic-efficacy. Their limited experience with inquiry, service learning, and creative problem-solving may have been factors contributing to their need for greater teacher support. Therefore students' sense of self-efficacy was lower than anticipated and their potential for a successful service learning experience may have been compromised.

The Teacher-Directed Inquiry group had greater teacher support, thereby limiting student frustration, which supported student self-efficacy. The teacher provided the scaffolding and

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guidance which enabled students to work through the challenges they encountered and helped them to overcome difficulties. This may have contributed to the findings that although no significant differences were found between groups regarding civic responsibility, and the Teacher-Directed Inquiry group did not participate in service learning, the Teacher-Directed Inquiry group maintained similar levels of civic self-efficacy, connection to community, and civic awareness as did the Student-Directed Inquiry group. Likewise, Tuan et al. (2005) reported that students need strong self-efficacy in order to persist in an inquiry. It was also stated that students have to value the activity to effectively decide if they want to participate in it.

Participation in the service-learning project for the present study was voluntary. According to Terry, Bohnenberger, Renzulli, Cramond & Sick (2008), students who engage in direct involvement community action activities are participating in the highest level of service learning. These projects require students to go above and beyond supplying a service. They require students to solve a problem. This involves a deeper commitment. Students must learn about the need, analyze the situation, generate novel ideas, and implement an action plan. A student must be highly civic-minded to engage in a voluntary service learning project that takes time outside of school for no school credit. There were 15 students in the Student-Directed Inquiry group who withdrew from the study and did not complete their service project. However, the researcher does not know the exact reasons for these withdrawals. It was established, however, that those who completed the service learning project were similar in their sense of civic responsibility to the Teacher-Directed Inquiry group who did not participate in a service learning project.

Gubbins (1982) revealed the problem that within the Schoolwide Enrichment Model many students do not see their individual or small group projects to completion. She found that

students reported having low-levels of interest in the topic and cited this as their reason for failing to complete the projects. The current study presented a 66% completion rate for the service projects ($n = 29/44$). This is better than Reis's (1981) findings from her study indicating that only 36% of students in the Revolving Door Identification Model completed a Type III project at the time of her study.

Blumenfeld et al. (1991) reported that students' motivation to engage in projects is tied to interest and perceived value in the task. If these levels are low, student motivation is compromised. In addition, learners must perceive that they have the competence or self-efficacy to perform the task and the ability to see difficulties as opportunities to overcome a challenge, rather than seeing them as frustrating situations. The higher scores in Learning Orientation and Mental Focus of the Teacher-Directed Inquiry group are indicative of students who were eager to learn and had the motivation to persevere in the task of solving a difficult problem. These students perceived value in the task they were doing. They were able to self-select a 21st Century issue that was relevant to them, thus promoting interest.

Chatterjee et al. (2009) found that students had more positive attitudes when they engaged in guided-inquiry. Students reported that their guided-inquiry lab reports were easy, took less time and effort, and were fun. Chaterjee et al. theorized that students preferred guided-inquiry as it was less laborious than open-inquiry. Moreover, students perceived the pragmatism of guided-inquiry as compared to open-inquiry, as it ultimately yielded the same grade with less effort. In the present study, the students in the Teacher-Directed Inquiry group were working for a grade. This may have been motivating for students and created an investment in the learning.

Scales, et. al (2000) reported that 31 hours or more of service learning led to students having higher perceived self-efficacy in helping others than students who participated in service

learning for fewer hours.   The present study was intended to include 31 hours. However, due to

the unprecedented number of snow days, the commencement of the study was delayed and the

desired 31 hours of service learning was not met. The students in both groups engaged in inquiry

learning for a total of 23 hours at each site. This may have contributed to students in the

Student-Directed Inquiry group being similar in their perception of their sense of civic

responsibility to the Teacher-Directed Inquiry group that did not participate in PBSL.

Research question 3. According to the authors of the CM3, students with high

Cognitive Integrity are motivated to consider multiple viewpoints and arrive at the truth by

integrating pertinent information and synthesizing it (Giancarlo, 2010). They enjoy challenge

and complexity as well as interacting with others. They are open-minded and decisive.   In

contrast, students with low Cognitive Integrity are often close-minded, do not find value in

information seeking, often do not waiver from their own viewpoints, and find change and

complexity uncomfortable (Giancarlo, 2010). In the present study, students, regardless of

assignment to group, who had high Cognitive Integrity scores, also revealed higher civic

responsibility scores. In fact, Cognitive Integrity was the most significant contributing factor in

predicting a student's civic responsibility. These results may indicate that students with high

Cognitive Integrity are predisposed to being civic minded.

<div align="center">

Implications for Education

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The teacher in the Teacher-Directed Inquiry group provided a sufficient degree of

scaffolding for the students such as providing research materials, asking guiding questions,

presenting mini-lessons on interview skills, implementing time guidelines, offering graphic

organizers, and scheduling check-ins, to help students with their projects. These practices

enabled students to perceive the challenges encountered in their inquiry as surmountable. These

supports also served to strengthen the students' skills and enabled them to continue on to the next phase of their projects. Students were able to ask questions and maintain certainty that they were executing each step as expected. In effect, the greater teacher support and facilitation contributed to student motivation to utilize their critical thinking skills. Participants in the Student-Directed Inquiry may have benefited from more Type II experiences designed to teach organizational and process skills for independent projects. These additional supports may have contributed to the students feeling more self-efficacious. Burns (1990) found that there was significant value in teaching process skills including project management, focus, and planning skills. These lessons would provide students with strategies for creative productivity. Students who have not had prior experience with Type III projects may require multiple Type II experiences before gaining the self-efficacy to successfully embark on a student-directed open-inquiry project.

Scaffolding is hierarchical. As reported by Herron (1971) inquiry exists on a continuum of teacher-directedness concluding with students directing the learning. Teachers value the teaching methodology of inquiry, but do not always know how to implement it or understand what the components are of an open-inquiry. Therefore, teacher training is essential. Teachers who are inexperienced with inquiry, and students who are novices with inquiry, benefit from starting at the more scaffolded, guided end of the levels of inquiry scale. When both students and teachers master the confirmation or structured levels of inquiry, then moving along the continuum to a guided-inquiry is appropriate for the successful implementation of inquiry. While we are still at the genesis of inquiry teaching, it is prudent to be mindful of the levels of inquiry and to seek mastery at each step. This slow foray into inquiry will serve to build the

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confidence of teachers and students alike, as well as adapt the current mindset to a more creative, open-ended learning experience.

Many students are taught from the beginning of their educational careers that teachers' questions often have one correct answer. Many students' are not used to open-ended processes or outcomes. These may present an unstable environment for them. Therefore, students need significant training in inquiry processes. Without scaffolded experiences, they endure discomfort, which impacts their performance and self-efficacy. Teacher guidance through potential problems related to service learning is beneficial. Assistance and clarification are necessary pieces of a successful student problem-based service learning experience (Whitfield, 1999).

The value of service-learning and open-inquiry continues to be recognized. As we move toward that goal, teacher training is critical. More opportunities for teachers to gain experience with the methodology will lead to realizing the shift from traditional instruction towards open-ended inquiry. Teacher training in the Enrichment Triad Model would be beneficial for teachers. As students gain exposure to new content and ideas through Type I introductory experiences, Type II experiences, where students learn process skills, are promising ventures to increase students' self-efficacy for successful Type III inquiries (Burns, 1990).

Implications for Future Research

Future areas for research include implementation of a study similar to this one with a new sample of students who have had greater prior experience with inquiry or who are monitored as they move through the levels of inquiry. A recommendation to assist with differentiation is to pre-assess students' process skills to identify the necessary Type II experiences students require to successfully engage in Type III inquiries. Training should also include lessons on how

teachers can effectively facilitate an open-inquiry. More hours of teacher training in CPS and other process skills such as planning, organizing, and generating an open-inquiry would be necessary for future studies. Teachers also require training about service learning, beginning with an agreed upon definition and multiple examples. Performing a service-learning project within the students' own community would be recommended as it would provide a deeper connection to their community. It could be expanded globally in future studies.

Other recommendations for future research include expanding the sample size as this sample was relatively small. In addition, a longer study may yield stronger outcomes.

Limitations of the Study

There are several limitations that affected this study. The instrument, CRS, was a possible threat to internal validity because it is a reactive measure. For this reason, a posttest only design was implemented. History was a factor as the treatment and comparison groups were in separate schools with unprecedented winter weather leading to multiple school cancellations for students. This compromised the timing of the study. The researcher could not control external events or influences that occurred at the various sites of the schools. School cultures and strategic goals differed at the two sites. It was important for the treatment to be delivered equally to all student participants.

To ensure that the PBSL was implemented with integrity, a reflection journal was kept by participants in the Student-Directed Inquiry group, and checked regularly by the researcher. Moreover, to ascertain that the research findings could be attributed to the PBSL project, not an individual's teaching style, several different teachers administered the treatment. However, the students began the reflection journal in advisory groups, but when they were asked to complete it

independently, did not always comply. To ensure that students engaged in reflective practice, participants completed additional reflections before and after the projects were submitted.

The study would have been of greater quality and stronger design if students had more teacher support during the PBSL project and if larger numbers of students participated in the study for its entire duration. In addition, the advisors would have benefitted from more professional development to fully understand open-inquiry and scaffolding. The two sessions to introduce the service learning project and to review the handbook may have been insufficient. Even with monitoring, and access to the researcher, the advisors who were volunteers, found the open-inquiry challenging due to their lack of experience with the methodology.

To address issues of mortality, students were offered an incentive for participation. Students were entered into a raffle for a technology gift card if they completed the study. The PBSL being voluntary in nature was a limitation for students as well.

Students in the Student-Directed Inquiry group and the Teacher-Directed Inquiry group were in separate schools. Therefore, there was little threat of competition between groups.

The external validity was limited by the fact that the Student-Directed Inquiry group and Teacher-Directed Inquiry group were intact classes neither randomly selected nor randomly assigned. The two groups were similar in demographics, however it will be the responsibility of future researchers to follow the same program in their environment in order to assess applicability.

Conclusions

We are in the beginning of the paradigm shift from didactic teacher-focused instruction, to an inquiry-based, student centered approach to teaching and learning. As students experience inquiry at more structured levels from early on, their self-assurance with less restrictive

parameters may lead to more successful open inquiries. In turn, as students become more familiar with the open-inquiry methods and CPS, it is hoped that they will be more proficient with divergent and convergent thinking processes. For now, students in the present study benefitted from a moderate degree of guidance and structured support from their teachers as they explored this new approach to instruction. In the future, as the teachers move along the continuum of inquiry levels towards more open-ended, student-directed inquiry approaches, students should find more stability within that model. As a result, our students will reap the educational benefits of developing 21st Century skills for future success.

Ethics Statement

According to the procedures required by the Western Connecticut State University (WCSU) Institutional Review Board (IRB), strict ethical procedures were primary when considering the implementation of this study. Prior to any study discussion or data collection, the approval of the WCSU IRB for the initial proposal was obtained. Once approval was achieved, the process of gaining informed consent began.

To assure that appropriate protocol was followed, the researcher met with the principals and the teachers in both schools to fully explain the purpose of the study. To assure confidentiality, students', teachers', and school names were not used. All data were assigned codes and were kept private at the home of the researcher. The results were shared with school staff members who can then share them with staff members and parents.

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Appendix A: Detailed Treatment Timeline

Detailed Treatment Timeline

Student-directed inquiry group

In advisory, students in the Student-Directed Inquiry group met every other week for the second half of the year. In the first session of March, they read about the day in the life of a Tanzanian student then compared it to a day in their own life. In the second session, students engaged in problem finding. They played a game to encourage taking multiple perspectives such as that of a child in Tanzania, a student in the United States, a parent in Tanzania, and so forth. Students generated original problem statements, then shared them with a partner and they brainstormed together to expand their ideas of the nature of the problem and agreed upon a problem statement. Upon completion of each session, students engaged in a written reflection about their processes of brainstorming, creativity, and perspective taking.

At the commencement of the study in March, social studies students began a unit on the 1920s and 1930s, which was conducted on a daily basis for 40 minutes per day. The teachers and this researcher developed this unit of study. Students were taught mess-finding, the first step in the creative problem solving process, as they were charged with identifying the most influential person of this era, explaining why he or she was famous, and justifying that this person should still be taught in schools today. After learning the proper brainstorming techniques, students brainstormed what would be criteria to declare someone the most influential. Analysis of the mess followed. By conducting research online and in the library, students evaluated whether or not there was enough information on this individual to be declared most influential, and then categorized the information found. They students began to do fact finding on a selected individual by asking questions that needed to be answered, then conducting research and culling out extraneous information versus important information. After being

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introduced to the language of creativity and critical thinking including the terms; convergent and divergent thinking, analyzing, open-mindedness, flow, flexible thinking, original and novel ideas, fluency, and elaboration of ideas, teachers and students utilized these terms to describe their thinking. Within this unit, students also learned about problem finding. Students were taught to evaluate the quality of their references. They were also trained to use critical thinking by preparing both sides of an argument for why this person was or was not most influential and found information that both supported and disproved the arguments they made. Multiple techniques to enhance their creative thinking were introduced and utilized. In addition, students were required to investigate the effect their individual had on important issues of the times, such as prohibition, and evaluate the influence of their individual within this context. Finally, when students had gathered enough information and committed to a person they believed was the most influential, they created a poster of their person or issue with all information included as well as pictures, then made a presentation to their peers in one class, and had a debate in the other class.

The researcher checked in with the social studies teachers on a weekly basis to obtain reports of how lessons were progressing and clarify any misunderstandings or problems.

The next unit began in April. Students in the Student-Directed Inquiry group learned about World War II in their social studies classes. This unit of study was also developed in partnership with this researcher. Teachers reviewed the CPS process (Isaksen & Treffinger, 1985) through their unit of study. Students analyzed a movie, book, or video game that was set during World War II and evaluated it for accuracy. No students elected to interview a relative. This time, students utilized the CPS process on a more independent level than the previous unit as the teacher gradually released control over the process to the students. The students worked in small groups for this project. The teachers did not provide direct instruction of CPS, but

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facilitated its implementation by providing templates to utilize. Moreover, the teachers

conversed with students, determined their level of support needed in applying the process, and

provided scaffolded support and guidance. Students analyzed the mess for what game or movie

they wanted to research. Then, students completed a graphic-organizer chart detailing what they

knew regarding World War II, and what they wanted to know. Students then made multiple

observations about their movie, book, or video game including what they saw and heard such as

clothing, architecture, technology, speech patterns, and so forth. They also made notes of what

inferences they gathered. Students then generated problem statements based on their data,

analyzed these statements and selected the most viable ones, and conducted research to find

answers. Students generated ideas for how they would improve their books, video games, or

movies for accuracy utilizing previously learned creative thinking techniques. Students also

generated additional scenarios that were time and event appropriate for World War II. Students

presented their findings to their class through a variety of student-selected projects such as:

reenacted videos or photo stories that depicted additional or improved scenes, Powerpoint

presentations with screen shots that detailed the accurate details as well as the inconsistencies for

the times, and dioramas with action figures.

In advisory groups, students utilized what they knew about creative techniques to

independently find ideas or solutions to their problem statements regarding students' education

in Tanzania. In the following sessions of advisory, students utilized critical thinking skills to

evaluate their solutions, select the best solution, and commit to a service-project. The researcher

spoke to each of the 14 advisors in person to inquire about the progress of the service learning

projects and answer any questions.

In May, students in the Student-Directed Inquiry group independently performed their service project. The researcher spoke directly with students to clarify the final stage of the service learning projects. Students were able to ask questions and were given a deadline for project completion. Projects included; a half-court foul shooting contest where the entry fee was the contribution of school supplies for students in Tanzania, a lemonade stand to earn money to buy maps for students in Tanzania, a bake sale to raise money to purchase notebooks, pencil collections throughout the school, school supply collections at local businesses and in students' neighborhoods, writing a letter to a government official to draw attention to the problem of education in Tanzania, and so forth. Upon completion of their service projects, the health teacher collected the supplies for students in Tanzania, and recorded the students as having completed the projects. Supplies were turned over to Afya. Students completed final reflections on their service learning experience.

Teacher-directed inquiry group

In the Teacher-Directed Inquiry group, students continued their Capstone project throughout the months of March and early April. Students received instruction on evaluating resources for research and citations. The teacher delivered lessons on how to conduct an interview. Students generated lists of 10 questions to ask the interviewee. They also utilized an organizer to record their position on the issue and collected data that supported or rejected their position.

In April, students in the Teacher-Directed Inquiry group conducted interviews and other research. Students received instruction in English class about writing the research report for this project. Students were given multiple check-points throughout April and May as they completed their research papers and promotional pieces.

At the end of May, the Teacher-Directed Inquiry group completed a final project along with the written research report supporting their 21st Century issue. Projects for their promotional piece were primarily hypermedia presentations on multiple topics including global warming, abortion, gun control, animal cruelty, and homelessness. Another group made a tri-fold pamphlet on smoking. Students completed a written reflection on their project as well as a group evaluation.

Appendix B: Letter and Consent Form (Superintendent)

December 2010
Dear (Superintendent): (Site 1)

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The purpose of this study is to determine the effects of a problem-based service-learning program on creative problem-solving, critical thinking, and students' sense of civic responsibility.

I will be using two surveys to collect data at the beginning and end of the study. The *California Measure of Mental Motivation* (CM3) will be administered to students to measure student perceptions of critical thinking skills and creative problem-solving. The *Civic Responsibility Survey* will be administered to collect students' perceptions of civic activities. All surveys will be administered during advisory periods via paper and pencil. Each assessment tool to be completed by the students will take approximately 10-20 minutes to administer. Students will also submit all work completed during the service learning project. This research study has been reviewed and approved by Western Connecticut State University's Institutional Review Board (1011-67). Participation in this study is completely voluntary and subjects may withdraw at any time. Students who agree to participate will submit all information to the researcher. The classroom teacher will not know which students and parents have given their consent to participate in the study. Therefore, program participation will not impact a student's grades. Privacy will be protected. Subjects' (district, school, teacher, student) will be numerically coded. All identities will be maintained in a secure location to protect confidentiality. Results will only be reported in aggregate form.

Social studies teachers who agree to participate in the implementation of the creative problem-solving skills will receive training from the researcher in the utilization of these methods. Advisors will receive materials and support to guide implementation of the service learning. Ms. Kipper will approve all curriculum. Upon completion of the project, Farragut Middle School will have a formalized curriculum for service learning. A description of the final project will be available to all school personnel.

I wish to thank administrators in the Hastings –on –Hudson School district for considering participation in this study. It is hoped that results of this investigation will enable educators to better understand outcomes related to problem-based service learning. If you have any questions, please feel free to contact me.
Sincerely,
Stephanie Bell   Marcia Delcourt, PhD
                                              Coordinator, EdD in Instructional Leadership
bells@hastings.k12.ny.us   *delcourtm@wcsu.edu*

I agree that the study described above can be conducted in (name of school district).

_____   _____   _____
Please Print Name   Signature   Date

December, 2010
Dear (Superintendent), (Site 2)

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The purpose of this study is to determine the effects of a problem-based service-learning program on creative problem solving, critical thinking, and students' sense of civic responsibility.

I will be using two surveys to collect data at the beginning and end of the study. The *California Measure of Mental Motivation* (CM3) will be administered to students to measure student perceptions of critical thinking skills and creative problem-solving. The *Civic Responsibility Survey* will be administered to collect students' perceptions of civic activities. All surveys will be administered during advisory periods via paper and pencil. Each assessment tool to be completed by the students will take approximately 10-20 minutes to administer.

This research study has been reviewed and approved by Western Connecticut State University's Institutional Review Board (1011-67). Participation in this study is completely voluntary and subjects may withdraw at any time. Students who agree to participate will submit all information to the researcher. The classroom teacher will not know which students and parents have given their consent to participate in the study. Therefore, program participation will not impact a student's grades. Privacy will be protected. Subjects' (district, school, teacher, student) will be numerically coded. All identities will be maintained in a secure location to protect confidentiality. Results will only be reported in aggregate form.

This site has been selected as the comparison site. The students will not be engaging in the treatment. Upon completion of the project, the researcher will discuss results with you. A description of the final project will be available to all school personnel.

I wish to thank administrators in the Bethel School District for considering participation in this study. It is hoped that results of this investigation will enable educators to better understand outcomes related to problem-based service learning. If you have any questions, please feel free to contact me.

Sincerely,
Stephanie Bell   Marcia Delcourt, PhD
                                         Coordinator, EdD in Instructional Leadership
bells@hastings.k12.ny.us   *delcourtm@wcsu.edu*
I agree that the study described above can be conducted in (name of school district).

_____   _____   _____
Please Print Name   Signature   Date

Appendix C: Cover Letter and Consent Form (Principal)

December, 2010
Dear (Principal): (Site 1)

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The purpose of this study is to determine the effects of a problem-based service-learning program on creative problem solving, critical thinking, and students' sense of civic responsibility.

I will be using two surveys to collect data at the beginning and end of the study. The *California Measure of Mental Motivation* (CM3) will be administered to students to measure student perceptions of critical thinking skills and creative problem-solving. The *Civic Responsibility Survey* will be administered to collect students' perceptions of civic activities. All surveys will be administered during advisory periods via paper and pencil. Each assessment tool to be completed by the students will take approximately 10-20 minutes to administer. Students will also submit all work completed during the service learning project. This research study has been reviewed and approved by Western Connecticut State University's Institutional Review Board (1011-67). Participation in this study is completely voluntary and subjects may withdraw at any time. Students who agree to participate will submit all information to the researcher during a non-instructional time period.. The classroom teacher will not know which students and parents have given their consent to participate in the study. Therefore, program participation will not impact a student's grades. Privacy will be protected. Subjects' (district, school, teacher, student) will be numerically coded. All identities will be maintained in a secure location to protect confidentiality. Results will only be reported in aggregate form.

Social studies teachers who agree to participate in the implementation of the creative problem-solving skills will receive training from the researcher in the utilization of these methods. Advisors will receive materials and support to guide implementation of the service learning. All curriculum will be approved by you prior to implementation. Upon completion of the project, Hastings Middle School will have a formalized curriculum for service learning. A description of the final project will be available to all school personnel.

I wish to thank administrators in the Hastings –on –Hudson School district for considering participation in this study. It is hoped that results of this investigation will enable educators to better understand outcomes related to problem-based service learning. If you have any questions, please feel free to contact me.
Sincerely,
Stephanie Bell   Marcia Delcourt, PhD
                                                          Coordinator, EdD in Instructional Leadership
bells@hastings.k12.ny.us   *delcourtm@wcsu.edu*
I agree that the study described above can be conducted in (name of school district).

_____   _____   _____
Please Print Name   Signature   Date

December, 2010
Dear (Principal), (Site 2)

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The purpose of this study is to determine the effects of a problem-based service-learning program on creative problem solving, critical thinking, and students' sense of civic responsibility.

I will be using two surveys to collect data at the beginning and end of the study. The *California Measure of Mental Motivation* (CM3) will be administered to students to measure student perceptions of critical thinking skills and creative problem-solving. The *Civic Responsibility Survey* will be administered to collect students' perceptions of civic activities. All surveys will be administered during advisory periods via paper and pencil. Each assessment tool to be completed by the students will take approximately 10-20 minutes to administer.

This research study has been reviewed and approved by Western Connecticut State University's Institutional Review Board (1011-67). Participation in this study is completely voluntary and subjects may withdraw at any time. Students who agree to participate will submit all information to the researcher during a non-instructional time period. The classroom teacher will not know which students and parents have given their consent to participate in the study. Therefore, program participation will not impact a student's grades. Privacy will be protected. Subjects' (district, school, teacher, student) will be numerically coded. All identities will be maintained in a secure location to protect confidentiality. Results will only be reported in aggregate form.

This site has been selected as the comparison site. The students will not be engaging in the treatment. Upon completion of the project, the researcher will discuss results with you. A description of the final project will be available to all school personnel.

I wish to thank administrators in the Bethel School District for considering participation in this study. It is hoped that results of this investigation will enable educators to better understand outcomes related to problem-based service learning. If you have any questions, please feel free to contact me.

Sincerely,
Stephanie Bell   Marcia Delcourt, PhD
                                        Coordinator, EdD in Instructional Leadership
bells@hastings.k12.ny.us   *delcourtm@wcsu.edu*
I agree that the study described above can be conducted in (name of school district).

_____   _____   _____
Please Print Name   Signature   Date

Appendix D: Cover Letter and Consent Form (Teacher)

December 2010
Dear Teacher, (Site 1)

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The purpose of this study is to determine the effects of a problem-based service-learning program on creative problem solving, critical thinking, and students' sense of civic responsibility.

I will be using two surveys to collect data at the beginning and end of the study. The *California Measure of Mental Motivation* (CM3) will be administered to students to measure student perceptions of critical thinking skills and creative problem-solving. The *Civic Responsibility Survey* will be administered to collect students' perceptions of civic activities. All surveys will be administered during advisory periods via paper and pencil. Each assessment tool to be completed by the students will take approximately 10-20 minutes to administer. Students will also submit all work completed during the service learning project. This research study has been reviewed and approved by Western Connecticut State University's Institutional Review Board (1011-67). Participation in this study is completely voluntary and subjects may withdraw at any time. Students who agree to participate will submit all information to the researcher. The classroom teacher will not know which students and parents have given their consent to participate in the study. Therefore, program participation will not impact a student's grades. Privacy will be protected. Subjects' (district, school, teacher, student) will be numerically coded. All identities will be maintained in a secure location to protect confidentiality. Results will only be reported in aggregate form.

Social studies teachers who agree to participate in the implementation of the creative problem-solving skills will receive training from the researcher in the utilization of these methods. Advisors will receive materials and support to guide implementation of the service learning. All curriculum will be approved by Ms. Kipper prior to implementation. Upon completion of the project, Hastings Middle School will have a formalized curriculum for service learning. A description of the final project will be available to all school personnel.

I wish to thank teachers in the Hastings-on-Hudson School district for considering participation in this study. It is hoped that results of this investigation will enable educators to better understand outcomes related to problem-based service learning. If you have any questions, please feel free to contact me.
Sincerely,
Stephanie Bell   Marcia Delcourt, PhD
                                                 Coordinator, EdD in Instructional Leadership
bells@hastings.k12.ny.us   delcourtm@wcsu.edu
I agree that the study described above can be conducted in (name of school district).

_____   _____   _____

Please Print Name   Signature   Date

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December 2010
Dear Teacher, (Site 2)

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The purpose of this study is to determine the effects of a problem-based service-learning program on creative problem solving, critical thinking, and students' sense of civic responsibility.

I will be using two surveys to collect data at the beginning and end of the study. The *California Measure of Mental Motivation* (CM3) will be administered to students to measure student perceptions of critical thinking skills and creative problem-solving. The *Civic Responsibility Survey* will be administered to collect students' perceptions of civic activities. All surveys will be administered during advisory periods via paper and pencil. Each assessment tool to be completed by the students will take approximately 10-20 minutes to administer.
This research study has been reviewed and approved by Western Connecticut State University's Institutional Review Board (1011-67). Participation in this study is completely voluntary and subjects may withdraw at any time. Students who agree to participate will submit all information to the researcher. The classroom teacher will not know which students and parents have given their consent to participate in the study. Therefore, program participation will not impact a student's grades. Privacy will be protected. Subjects' (district, school, teacher, student) will be numerically coded. All identities will be maintained in a secure location to protect confidentiality. Results will only be reported in aggregate form.

This site has been selected as the comparison site. The students will not be engaging in the treatment. Upon completion of the project, the researcher will discuss results with you. A description of the final project will be available to all school personnel.

I wish to thank the teachers in the Bethel School District for considering participation in this study. It is hoped that results of this investigation will enable educators to better understand outcomes related to problem-based service learning. If you have any questions, please feel free to contact me.
Sincerely,
Stephanie Bell   Marcia Delcourt, PhD
                                                        Coordinator, EdD in Instructional Leadership

bells@hastings.k12.ny.us   delcourtm@wcsu.edu

I agree that the study described above can be conducted in (name of school district).

_____ _____ _____
        Please Print Name   Signature   Date

Appendix E: Parental Consent Form

WESTERN CONNECTICUT STATE UNIVERSITY

Parent Consent Form to Participate in a Research Study

December, 2010
Dear Parent or Guardian, (Site 1)

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The research that I am conducting examines the effects of student engagement in a service-learning project on students' critical thinking, creative problem solving, and civic responsibility.

I will be using two surveys to collect data at the beginning and end of the project. The *California Measure of Mental Motivation* (CM3) will be administered to your child to measure his/her perceptions of critical thinking skills and creative problem solving. The *Civic Responsibility Survey* will be administered to collect students' perceptions of civic activities.

Individual student results of the surveys will not be reported to the district. However, upon completion of this study, overall results will be shared with Ms. Kipper to inform future service learning projects. Student names will be coded and remain confidential. Students will also submit all work completed during the service learning project. The purpose of this study is to inform educators about best practices in education and will be used for educational purposes only.

This research study has been reviewed and approved by Western Connecticut State University's Institutional Review Board (1011-67). The results of this study will provide information to help teachers develop instruction that stimulates students' critical thinking, creative problem solving, and sense of civic responsibility.

Participation in this study is completely voluntary. You are free to withdraw your child from the study at any time. All information is completely confidential. If you have any questions, please contact me via email at bells@hastings.k12.ny.us. If you agree to have your child participate in this study, please sign the attached statement and return it to your child's homeroom teacher_____ by _____.
                                     (name of social studies teacher)   (date)

I would like to thank the Hastings School District's administrators, teachers, parents, and students for participating in this exciting research study. I am sincerely grateful for your interest and support.
Sincerely,
Stephanie Bell

I, _____, the parent/legal guardian of the student/
(printed name of parent or guardian)
minor below, acknowledge that the researcher has explained to me the purpose of this
research study, identified any risks involved, and offered to answer any questions I may have
about the nature of my child's participation. I voluntarily consent to my child's participation.
I understand all information gathered during this project will be completely confidential.

Student/Minor's Name: _____

Signature of Parent or Guardian: _____

WESTERN CONNECTICUT STATE UNIVERSITY
Parent Consent Form to Participate in a Research Study

January, 2011
Dear Parent or Guardian, (Site 2)

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The research that I am conducting examines the effects of student engagement in a service-learning project on students' critical thinking, creative problem solving, and civic responsibility.

I will be using two surveys to collect data at the beginning and end of the project. The *California Measure of Mental Motivation* (CM3) will be administered to your child to measure his/her perceptions of critical thinking skills and creative problem solving. The *Civic Responsibility Survey* will be administered to collect students' perceptions of civic activities.

Individual student results of the surveys will not be reported to the district. However, upon completion of this study, overall results will be shared with Dr. Smith. Student names will be coded and remain confidential. The purpose of this study is to inform educators about best practices in education and will be used for educational purposes only.

This research study has been reviewed and approved by Western Connecticut State University's Institutional Review Board (1011-67). The results of this study will provide information to help teachers develop instruction that stimulates students' critical thinking, creative problem solving, and sense of civic responsibility.

Participation in this study is completely voluntary. You are free to withdraw your child from the study at any time. All information is completely confidential. If you have any questions, please contact me via email at bells@hastings.k12.ny.us.

If you agree to have your child participate in this study, please sign the attached statement and return it to your child's homeroom teacher_____ by
_____.   (name of social studies teacher)
   (date)

I would like to thank the Bethel School District's administrators, teachers, parents, and students for participating in this exciting research study. I am sincerely grateful for your interest and support.

Sincerely,
Stephanie Bell

I, _____, the parent/legal guardian of the student/
      (printed name of parent or guardian)

minor below, acknowledge that the researcher has explained to me the purpose of this
research study, identified any risks involved, and offered to answer any questions I may have
about the nature of my child's participation. I voluntarily consent to my child's participation.
I understand all information gathered during this project will be completely confidential.

Student/Minor's Name: _____

Signature of Parent or Guardian: _____

Appendix F: Cover Letter and Assent Form (Student)

WESTERN CONNECTICUT STATE UNIVERSITY
Student Assent Form to Participate in a Research Study

Dear Student, (Site 1)

Some of you may know me as a 5th grade teacher here at Farragut Middle School. Did you know that I am also a student? I go to school at Western Connecticut State University. I am doing an exciting research study. I would like you to be a part of my study. I will send a permission slip home with you. But first, I would like you to know about my study.
The study is about service learning. As you know, this year in advisory, you will be partnering with The Afya Foundation to help the children in Tanzania. I am interested in your feelings about citizenship and your thinking processes. If you choose to participate in this study, you will need to complete two short surveys: one is about thinking skills and the other is about community service. You will also submit all work completed during the service learning project.

I will not use your name in the study. I will use numbers instead of names. The surveys we use will have nothing to do with report card grades. All of the information will be kept private.

You will be a volunteer for this study. Being a volunteer means that you can withdraw from participating in the study at any time and you do not need to answer every question related to the study. If you have questions, please ask me via email at bells@hastings.k12.us.ny.
To thank you for participating in my study, I will enter your name into a drawing for an iTunes gift card. The drawing will be at the completion of the study.
If you would like to be in my study, please print and sign your name below:

_____

Print student name

X_____

Student signature

Thank you,
Mrs. Bell

WESTERN CONNECTICUT STATE UNIVERSITY
Student Assent Form to Participate in a Research Study

Dear Student, (Site 2)

Hello! My name is Mrs. Bell and I am a middle school teacher in New York. I am also a student. I go to school at Western Connecticut State University. I am doing an exciting research study and I would like you to be a part of my study. I will send a permission slip home with you. But first, I would like you to know about my study.

The study explores your feelings about citizenship and your thinking processes. If you choose to participate in this study, you will need to complete two short surveys: one is about thinking skills and the other is about community service.

I will not use your name in the study. I will use numbers instead of names. The surveys we use will have nothing to do with report card grades. All of the information will be kept private.

You will be a volunteer for this study. Being a volunteer means that you can withdraw from participating in the study at any time and you do not need to answer every question related to the study. If you have questions, please ask me via email at bells@hastings.k12.us.ny.
To thank you for participating in my study, I will enter your name into a drawing for an iTunes gift card. The drawing will be at the completion of the study.

If you would like to be in my study, please print and sign your name below:

_____
                         Print student name

X_____
                         Student signature

Thank you,
Mrs. Bell

December, 2010
Dear Parent/Guardian, (Site 1)

Hello! My name is Stephanie Bell and I am currently a fifth grade teacher at Farragut Middle School in Hastings-on-Hudson School District. I am very passionate about my job and deeply committed to student learning. As part of my own quest for professional growth, I am enrolled in a doctoral program at Western Connecticut State University. As an educator, I am consistently seeking new and innovative ways to improve student learning. Through my research, I am seeking to explore students' educational outcomes in service learning at the Farragut Middle School. As Ms. Kipper's letter states, the 8th grade this year has partnered with Afya and will be involved in a service-learning project for the children in Tanzania.

This letter is a request for your consent to allow your child to participate in a study that I will be conducting this spring. My research examines the effects of student engagement in a service-learning project on students' critical thinking, creative problem solving, and civic responsibility. To explore these effects, the advisors will be administering two short surveys to students to measure their motivation to use critical thinking and creative problem solving skills, as well as their sense of civic responsibility. Student names will be coded and kept completely confidential. Results will be used for educational purposes only. Students will also submit all work completed during the service learning project.

Attached you will find three forms (Research Description, Student Consent, and Parental Consent). These forms provide detailed information about the study and ask for you and your child to voluntarily consent to participate in this study. If you agree to have your child participate, please sign the Parental Consent form and have your child sign the Student Assent form and return them to your child's social studies teacher. Please note that your child is NOT required to participate in this study and there is no consequence for not participating. Any child may opt out of the study by not signing the permission forms.

If you have any questions regarding your child's participation, please do not hesitate to contact me via e-mail at bells@hastings.k12.ny.us.

I would like to thank the Hastings School District's administrators, teachers, parents, and students for participating in this exciting research study. I am sincerely grateful for your interest and support.

Thank you for your time and consideration.
Best regards,
Stephanie Bell

January, 2011

Dear Parent/Guardian, (Site 2)

Hello! My name is Stephanie Bell and I am currently a fifth grade teacher at Farragut Middle School in Hastings-on-Hudson School District. I am very passionate about my job and deeply committed to student learning. As part of my own quest for professional growth, I am enrolled in a doctoral program at Western Connecticut State University. As an educator, I am consistently seeking new and innovative ways to improve student learning. Through my research, I am seeking to explore students' educational outcomes in service learning.

This letter is a request for your consent to allow your child to participate in a study that I will be conducting this spring. My research examines the effects of student engagement in a service-learning project on students' critical thinking, creative problem solving, and civic responsibility. To explore these effects, students will complete two short surveys to students to measure their motivation to use critical thinking and creative problem solving skills, as well as their sense of civic responsibility. Student names will be coded and kept completely confidential. Results will be used for educational purposes only.

Attached you will find three forms (Research Description, Student Consent, and Parental Consent). These forms provide detailed information about the study and ask for you and your child to voluntarily consent to participate in this study. If you agree to have your child participate, please sign the Parental Consent form and have your child sign the Student Assent form and return them to your child's social studies teacher. Please note that your child is NOT required to participate in this study and there is no consequence for not participating. Any child may opt out of the study by not signing the permission forms.

If you have any questions regarding your child's participation, please do not hesitate to contact me via e-mail at bells@hastings.k12.ny.us.

I would like to thank the Bethel School District's administrators, teachers, parents, and students for participating in this exciting research study. I am sincerely grateful for your interest and support.

Thank you for your time and consideration.
Best regards,
Stephanie Bell