

EFFECT OF STYLE TRAINING ON FUTURE PROBLEM SOLVING PERFORMANCE

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The participants were grade 9-12 students ($n = 75$) from one suburban high school who were part of the Future Problem Solving Program (FPSPI). The research involved both quasi-experimental and correlational components. First, an ANCOVA was used to compare the mean scores of the Qualifying Problem (QP) for both the treatment and comparison groups with the independent variable being type of program with two levels: participation in problem solving styles training along with FPSPI (treatment) or FPSPI curriculum only (comparison), and the dependent variable being QP scores. After controlling for pretest scores, the treatment group outperformed the comparison group ($p = .008$). In addition, eight out of nine of the teams (89%) in the treatment group qualified for the state competition, while four out of twelve (33%) of the comparison groups qualified. Second, a hierarchical multiple linear regression procedure was used to determine to what extent and in what manner creative achievement predicted performance in writing a creative problem-solving scenario after accounting for participation in training about problem solving styles. Within the regression model, program type was a significant predictor ($p = .001$), explaining 38.3% of the variance in QP scores, while creativity of participants TTCT-Verbal, Fluency ($p = .313$), TTCT- Verbal, Flexibility ($p = .633$), and TTCT-Verbal, Originality ($p = .518$) were not significant predictors of QP scores. Third, qualitative data were coded based on themes to determine perceptions of the creative problem-solving process of students who learned about their problem-solving styles and those who did not. Participants in the treatment group made more statements than the members of the comparison group related to an understanding of self and others while participants from the comparison group made more statements than those in the treatment group about the technical aspects of FPSPI.

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APPROVAL PAGE



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Doctor of Education Dissertation

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Grantees who undertake such projects are free to use their professional judgment. Therefore, the results of this report do not necessarily represent the positions or policies of FPSPI, and no official endorsement should be inferred.

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CHAPTER ONE:

INTRODUCTION AND OVERVIEW OF THE TOPIC

Creativity has a place in education in the 21st century. Many researchers (e.g., Cramond, 1999; Fishkin, 1999; Robinson, 2006, 2010; Starko, 2010; Wagner, 2012; Zhao, 2012) have made a case that creativity is important in education. Robinson (2006) stated that creativity is important and should be treated with the same status as literacy. He argued that there is power in human diversity, yet the process of education currently disengages children from their natural talents (Robinson, 2010). Wagner (2012) recommended that educators need to be teaching students to collaborate, communicate, and think critically and creatively. Zhao (2012) argued that humans have both the desire and the potential to create and innovate and are also born with an inclination towards being social, and having a desire to communicate and collaborate.

Rationale

American students underperform in problem solving in relation to their international peers (OECD, 2014). First, it is imperative that educators understand and support students to improve their creative problem solving performance.

Creative Problem Solving (CPS) is a way to instruct students in creative thinking (Torrance & Torrance, 1978). The Global Issues Problem Solving component of the Future Problem Solving Program component (FPSP-GIPS) utilizes Creative Problem Solving (CPS). Teams of students work to collaborate on presented problems, as opposed to discovered problems as distinguished by Getzels (1964) and Herron (1971).

Guilford (1950) attempted to mobilize psychologists about the need for scientific studies in creativity as a way to nurture creativity in children. Guilford (1959) defined

creativity as a part of human intellect that combines divergent production of responses (variety of responses produced fluently, flexibly, and with originality), convergent production of responses, and the ability to evaluate responses (Guilford, 1959). Torrance (1979; 1995) built on this definition to define creative thinking as a process involving fluency (the production of a large number of ideas), flexibility (the production of ideas showing a variety of possibilities), elaboration (a process of enhancing ideas), and originality (the production of ideas that are unique or unusual).

Second, there is a distinction between creativity level and style which adds clarity and precision to understanding creativity (Isaksen, 2004). It is not clear whether CPS performance is related to creative thinking ability and if it is not, it is also unclear what the other factors are which can help educators support students.

Treffinger, Schoonover, and Selby (2013) suggested that learning should be concerned with instruction that leads to student thinking and that when students are taught to think critically and creatively and to be effective problem solvers, the possibility for success with various situations, goals and challenges increases. Treffinger (1986) defended weaving creativity into gifted programs because of the importance of creative productivity.

Treffinger, Isaksen and Stead-Dorval (2006) stated that the skills, processes, tools, and techniques used in creative problem solving can be taught. Treffinger (2011) recommended explicitly and deliberately teaching specific tools, techniques, and strategies for creativity.

Finally John-Steiner (2000) theorized that the creative process is enhanced through collaborative thinking. It is important for educators to understand what students are gaining from experiences working with a group.

Students' problem-solving styles can be assessed by *VIEW: An Assessment of Problem Solving Style* (VIEW, 2013) that was designed to determine how individuals may behave when managing change and solving problems (Selby, Treffinger, & Isaksen, 2007; Treffinger, Selby, Isaksen, & Crumel, 2007). The instrument has applications to support creative problem-solving in that it serves to define how individuals apply their own strengths and collaborate (Selby, Treffinger, & Isaksen, 2011).

Statement of the Problem

Treffinger (2011) argued that education must be responsive to the challenge of preparing students to deal with creativity, innovation and change, and that efforts are needed to provide students the opportunity to learn 21st century skills. While we know this is important, there is not enough research about creativity and innovation, critical thinking and problem solving, and communication and collaboration. We are also not clear about the factors influencing creative problem solving performance. Finally, we are not sure about the student perspective in participating in creative problem solving. Therefore, this study was developed to investigate how understanding and applying problem solving styles in a creative problem solving scenario effects Future Problem Solving performance and process.

The purposes of this study were threefold. First, the researcher attempted to determine if participation in training on problem-solving styles using VIEW (Selby et al., 2007) had an impact on performance in creative problem-solving (scores in FPSP-GIPS) for students in grades 9-12. Second, the researcher analyzed the relationship between creative thinking ability, problem-solving styles training, and performance in a creative problem-solving scenario. Third, the researcher also analyzed differences in performance and process, including perceptions about the creative problem-solving process regarding team and

individual strengths and weaknesses, by comparing students who learned about their problem-solving styles and those who did not.

Significance

According to The Partnership for 21st Century Skills (2009), creativity and innovation (involving thinking creatively, working creatively with others, and implementing innovations), critical thinking and problem solving, and communication and collaboration are important to the success of students in the 21st century. There is a need to substantiate effective ways to teach creativity, particularly for adolescents (Woodel-Johnson, 2010) as well as to enhance team performance. It is critical to understand how to best develop problem-solving skills to include 21st century skills in the curriculum. Given the need to teach creativity, critical thinking, collaboration and communication, this study was developed to investigate how understanding and applying problem-solving styles in a creative problem-solving scenario affects performance and process.

Potential Benefits

A potential benefit of the study may be an understanding of training in problem-solving styles using VIEW in relation to performance in a creative problem-solving scenario. In addition, an understanding of the relationship between creative thinking ability and training in problem-solving styles as a predictor for performance on a creative problem-solving scenario may be gleaned. Finally, an understanding of the perceptions of teams involved in training about their problem-solving styles as it applies to working collaboratively on a creative problem-solving scenario may be gained. This may help identify ways to improve dynamics in team performances as well as assist coaches with

strategies that may be helpful in working with students who are engaged in FPSPI or other similar programs.

Definition of Key Terms

The following terms are relevant to this study:

1. **Collaborative Learning** is a process in which students learn by working together on substantive issues. Teachers intervene infrequently, and group process is not evaluated by the teacher, as in cooperative learning, but instead regulated by the students themselves (Bruffee, 1995).
2. **Creative Problem Solving (CPS)** is a system for solving problems that involves four components (Understanding the Challenge, Generating Ideas, Preparing for Action, and Planning Your Approach) and eight stages (Constructing Opportunities, Exploring Data, Framing Problems, Generating Ideas, Developing Solutions, Building Acceptance, Appraising Tasks, and Designing Process), each with a balance of generating varied, unusual options and focusing thinking constructively (Treffinger, Isaksen, & Stead-Dorval, 2006; Isaksen, Dorval, & Treffinger, 2011).
3. **Future Problem Solving Program International (FPSPI)** is a competitive international problem-solving program that addresses these stated goals: (a) develop and use creative thinking skills; (b) learn about complex issues that may shape the future; (c) develop an active interest in the future; (d) develop and use written and verbal communication skills; (e) learn and utilize problem-solving strategies; (f) develop and use teamwork skills; (g) develop/use research skills;

and (h) develop and use critical and analytical thinking skills (Treffinger, Selby, & Crumel, 2012).

4. **Problem-Solving Styles** are consistent differences in the way individuals perform generating and focusing activities as well as an individual's disposition towards problem-solving, influenced by mindset, engagement, and attitudes. Preferences support productivity (Selby et al., 2007).
5. **VIEW: An Assessment of Problem Solving Style** is a 34-item instrument used to assess how individuals solve problems and manage change in 3 dimensions: Orientation to Change (OC), Manner of Processing (MP) and Ways of Deciding (WD) (Selby, Treffinger, & Isaksen, 2002).

CHAPTER TWO: REVIEW OF THE LITERATURE

Despite the fact that research on creativity has been conducted in education for more than six decades (e.g., Guilford, 1950), the construct has recently gained renewed interest and attention in the media (e.g., Bronson & Merryman, 2010) as well as in the professional literature (e.g., Scherer, 2013). This chapter presents a review of recent studies of creativity and creative thinking, Creative Problem Solving (CPS), collaborative learning, and problem-solving styles. These constructs form the theoretical and research foundation for the current study.

First, the chapter reviews the definition of creativity, issues related to its assessment with specific attention to the Torrance Tests of Creative Thinking (Torrance, 2008), and provides a summary of the theory, development, and research on Creative Problem Solving (CPS) as a method for teaching creative thinking and its relationship to instruction in creativity and problem solving skills. Second, this chapter presents a summary of the role of creativity in education specifically in the Future Problem Solving Program International (FPSPI), the foundational role of CPS in FPSPI, the process of FPSPI, and research on the program's effectiveness. The construct of collaborative learning and its relationships to FPSPI is also addressed. Third, the chapter provides an explanation of the emerging role of problem solving style, and an examination of studies in relationship to CPS, creative thinking, and FPSPI. The research questions and hypotheses are included at the conclusion of the chapter.

Creativity

This section describes creativity and its usefulness in preparing students for the 21st century. It includes a definition of creativity, an explanation of the assessment of creativity, and an explanation of Creative Problem Solving (CPS), a problem solving process that has evolved over the last 50 years, that links creativity with problem solving.

A Definition of Creativity

Fishkin (1999) suggested that defining creativity is complex. Treffinger (2000), after reviewing over 100 definitions of creativity, found that creativity can be defined in many ways. Beghetto and Kaufman (2007) suggested the creative process involves the construction of personal knowledge and understanding. Plucker, Beghetto and Dow (2004) argued that creativity is an important component of problem solving as well as other cognitive areas, social and emotional well-being, academic performance, and career success. Cramond (1999) noted that creative ability can change over time that makes a case for its inclusion in education because students have the potential to make gains in this area.

Guilford defined creativity as divergent thinking involving fluency, flexibility, originality, and elaboration (Guilford, 1956, 1960, 1986). Fluency involves the production of a large number of ideas. Flexibility refers to the production of ideas showing varied ideas. Elaboration involves the process of enhancing ideas by refining them or adding details. Originality includes the production of ideas that are unique or unusual (Torrance, 1979, 1995). Torrance (1966) defined creativity as a sensitivity to deficiencies or gaps, identification of those gaps, searching for solutions, taking guesses and formulating hypotheses, testing, retesting and modifying, and communicating results. For the purposes of this study, Guilford's and Torrance's definitions will be utilized.

Assessment of Creativity

Torrance originally designed the TTCT tests to be used as a way to individualize instruction (Torrance 1966; 1974). Cramond, Matthews-Morgan, Torrance, and Zuo (1999) proposed that given the extensive amount of validity and reliability data available over time and throughout different cultures, the Torrance Tests of Creative Thinking (TTCT) are the best standardized measurement tools available to assess creative thinking. Chase (1985) noted that TTCT does not completely operationalize Torrance's definition of creativity, but Cramond (1999) found the TTCT, a set of performance measures that samples creative behaviors, can identify creativity levels at a given moment.

More than 2,000 research studies have used the Torrance Tests of Creative Thinking (TTCT), developed originally to measure the constellation of mental abilities used in creative achievements that, when present in high degrees, increase the chance that an individual will behave creatively (Torrance, 2008). Kim (2011a) analyzed data from 45 years of work with the Torrance Test of Creative Thinking- Figural (TTCT-Figural). The TTCT-Figural tests the areas of fluency, originality, elaboration, abstractness of titles, resistance to premature closure, and 13 creative personality traits. Kim's analyses suggested that fluency, originality, elaboration, abstractness of titles, and resistance to premature closure have significantly decreased in several areas. She reported that scores decreased significantly from 1990-1998 $t(142,504) = 23.84, p < .001$, and then again from 1998-2008 $t(124,167) = 11.1, p < .001$. In the area of originality, scores decreased significantly from 1990-1998: $t(142,504) = 16.85, p < .001$ and remained static from 1998-2008. Elaboration scores showed a significant increase from 1966-1974 $t(22,259) = 20.33, p < .001$, a significant decrease from 1984-1990: $t(126,167) = 106.14, p < .001$, and another significant decrease from 1990-1998: $t(124,167) =$

103.20, $p < .001$. In the area of abstractness of titles, scores decreased significantly from 1998-2008 $t(124,167) = 24.82, p < .001$. Resistance to premature closure scores decreased significantly from 1984-1990 $t(126,167) = 40.35, p < .001$, increased significantly from 1990-1998 $t(142,504) = 120.38, p < .001$, and decreased significantly from 1998-2008 $t(124,167) = 9.45, p < .001$.

Treffinger (2012a) critiqued Kim (2011a), arguing that the data were analyzed from multiple cumulative and normative samples from 1974, 1984, 1990, 1998; and 2008. The subjects in the Kim (2011a) study were not retested independently for the purposes of her study but were only part of a growing data set. Treffinger (2012a) argued there was no evidence that the samples were representative of the same population as in the original set of data. In addition, because a sample of convenience was used in the study, there was no indication that the sample represented the population at large (Treffinger, 2012a).

Another longitudinal study (Runco, Millar, Acar, & Cramond, 2010) used the TTCT with participants ($n = 60$) who were originally administered the TTCT in 1958-1964. The results indicated the contributions of creative thinking ability to the prediction of future outcomes. Participants from a 1998 follow-up study, which was completed in Minnesota, were contacted by mail in 2008. Four scores from the original TTCT administration (fluency, flexibility, originality, and elaboration) were used as well as the Creative Style of Life, that measures public and personal achievement.

The results showed that personal achievement significantly correlated with some TTCT scores (fluency $r = .29, p = .014$, flexibility $r = .22, p = .05$, elaboration $r = .27, p = .02$). In addition, individual TTCT composite scores significantly correlated with personal ($r = .35, p = .04$) and public achievement ($r = .30, p = .012$). These results, coupled with

Cramond's (1999) assertion that creativity can change over time, and the need to substantiate effective ways to teach creativity (Woodel-Johnson, 2010), underscore the need to investigate methods to teach students to think creatively because of the impact that creative thinking can have on future performance.

Creative Problem Solving

The Creative Problem Solving (CPS) process deliberately links creativity to an interactive system for solving problems (Isaksen, Dorval, & Treffinger, 2011). CPS is a system that involves four components (Understanding the Challenge, Generating Ideas, Preparing for Action, and Planning Your Approach) and eight stages (Constructing Opportunities, Exploring Data, Framing Problems, Generating Ideas, Developing Solutions, Building Acceptance, Appraising Tasks, and Designing Process), each with a balance of generating varied and unusual options to constructively focus thinking throughout the problem solving process (Treffinger, Isaksen, & Stead-Dorval, 2006).

Isaksen and Treffinger (2004) detailed the history and evolution of CPS. Osborn (1952) made the creative process more explicit with a comprehensive description of a process that originally involved seven stages. This method then evolved over time to the Osborn-Parnes model of CPS by Osborn (1963), Parnes (1967a;1967b); Noller and Parnes (1972), Parnes and Noller (1972a, 1972b, 1973), Reese, Treffinger, Parnes, and Kaltsounis (1976), Noller (1979); Noller, Parnes, and Biondi (1976); Parnes, Noller, and Biondi (1977), Treffinger, Isaksen, and Firestien (1982), Parnes (1987), and Parnes (1988). Researchers involved in the Cognitive Styles project (Isaksen, 2004) investigated effects of individual differences when learning and applying CPS that led to further modification of the Osborn-Parnes model by Isaksen and Treffinger (1985); Isaksen and Treffinger (1991); Treffinger

and Isaksen (1992); Isaksen and Dorval (1993); Isaksen, Dorval, and Treffinger (2000); Treffinger, Isaksen, and Dorval (2000) that ultimately led to the current development of CPS 6.1™ that involves four components and eight stages. Treffinger and Jackson (2012) identified that FPSPI uses a version of CPS which involves six stages.

The effects of CPS were studied by Firestien and McCowan (1988), who investigated differences in the communication behaviors of 22 teams trained in CPS and 18 teams not trained in CPS by examining the amount of participation in group work, verbal criticism used, verbal support offered, verbal humor utilized, non-verbal humor demonstrated, and quantity of ideas generated. Students in an introduction to Creative Studies course at a northeastern university ($n = 110$) were randomly assigned to one of 22 teams as part of the treatment. Participants ($n = 90$) from undergraduate courses in business, interdisciplinary studies, consumer science, and home economics were randomly assigned to 18 teams and were not provided with training. Results showed there was a significant difference between individuals in the treatment and control groups, $F(6,33) = 11.02, p < .001$, with students in the CPS group participating more often in the group, $F(1,28) = 24.16, p < .001$; criticizing peers less often, $F(1,28) = 17.56, p < .001$; supporting ideas more, $F(1,28) = 14.34, p < .001$; using more verbal humor, $F(1,28) = 19.37, p < .001$; using more non-verbal humor, $F(1,28) = 22.42, p < .001$; and generating significantly more ideas, $F(1,28) = 40.72, p < .001$, than the control group members.

Another study on CPS done by Schack (1993) examined the effects of a CPS curriculum on students ($n = 214$) of varying abilities. Analysis included the effectiveness of 45 lessons using CPS on problem-fluency, solution-fluency, flexibility, originality and use of

criteria in response to a problem-solving task for students identified for programs for gifted, honors, or average students.

The quasi-experimental study involved middle school students and teachers from one district in a mid-sized city. Students in grades 6-8 identified as gifted ($n = 78$), honors ($n = 106$), and average students ($n = 83$) participated in the study. Four treatment and three comparison classes were heterogeneously grouped by ability. There was one homogeneous treatment group and one homogenous comparison group of each level of identified students: gifted, honors and average.

The treatment involved 45 lessons delivered over 9-18 weeks, including 10-15 lessons on group dynamics and 15-20 lessons on the CPS process. For the final lessons, the students used CPS to solve real-school problems. In four of six schools, teachers taught the lessons as a mini course within an existing course. Personnel at two of the schools taught it in a problem solving elective course. The comparison group participated in their usual classes during the time period the treatment occurred. Problem solving was assessed by having students respond to a hypothetical problem both before and after the treatment. Results were scored by two independent judges for problem fluency, solution fluency, flexibility, originality and use of criteria.

A repeated measures analysis of variance (ANOVA) showed the treatment group had significantly higher gains in problem solving ability than the comparison group. There was a two-way interaction for group ($p < .001$). Average and honors students in the treatment group showed gains that exceeded the gains of the gifted students in solution fluency, flexibility and originality. These improved scores indicated that that problem solving ability can be increased through instruction in CPS for all students.

Creativity in Education: Future Problem Solving Program International (FPSPI)

Numerous programs and methods support educational applications of the creative problem solving process. FPSPI, founded by E. Paul Torrance in 1974, is one such well-established program. Torrance and Torrance (1978b) described FPSPI as a national program with an interscholastic competition, and a curriculum project that integrates Creative Problem Solving (CPS) and future studies. From there, it developed into Future Problem Solving Program International (FPSPI) that incorporated multiple components for the purpose of engaging the creative strengths and talents of students in a variety of ways (Treffinger, Solomon, & Woythal, 2012).

Foundations of the Future Problem Solving Program International

FPSPI builds on a foundation that includes an explicit emphasis on process instruction and the development of collaboration and teamwork skills. FPSPI addresses these stated goals for students: (a) develop and use creative thinking skills; (b) learn about complex issues that may shape the future; (c) develop an active interest in the future; (d) develop and use written and verbal communication skills; (e) learn and utilize problem-solving strategies; (f) develop and use teamwork skills; (g) develop/use research skills; and (h) develop and use critical and analytical thinking skills (Treffinger, Selby, & Crumel, 2012).

Process instruction. The Future Problem Solving Program International (FPSPI) provides students opportunities to learn and apply CPS methods to present and future issues (Treffinger, Solomon, & Woythal, 2012). Teams of students or individuals enroll in one or more types of competitions. The three competitive components of FPSPI are: Global Issues Problem Solving (FPSP-GIPS), Community Problem Solving (CmPS) and Scenario Writing

(SW). FPSP-GIPS and CmPS have both team and individual competitions while SW is solely an individual competition.

Within each component, students are divided into three different levels: Junior (Grades 4-6), Middle (Grades 7-9) and Senior (Grades 10-12). CmPS participants select real problems in their community and apply critical and creative problem solving skills to develop an action plan. In SW, students work individually to compose futurist short stories (1,500 words) related to one of the current FPSP-GIPS topics. The Global Issues Problem Solving program (FPSP-GIPS) provides students the opportunity to use the FPSPI six-step CPS model to both explore challenges and to propose action plans that address complex societal problems posed by the organizers of FPSPI (Treffinger, Solomon, & Woythal, 2012).

Students involved in FPSP-GIPS receive training in a version of CPS as part of the program (FPSP-CPS). The model has six steps: (a) Identify Challenges; (b) Select an Underlying Problem; (c) Produce Solution Ideas; (d) Generate and Select Criteria; (e) Apply Criteria; and (f) Develop an Action Plan. Teams or individuals meet throughout the year to learn the FPSP-CPS process and to explore assigned research topics. Some teams meet as part of either gifted and talented programs or enrichment programs during school hours, before school, or after school. Others meet in community spaces in teams led by parents or other volunteers. Some of the teams include students who are homeschooled. FPSPI provides training for coaches and access to curriculum materials to those registered in the program.

In FPSP-GIPS, participants are provided with a complex problem and asked to gather facts and ideas to address a given issue involving business and economics, science and technology, or social and political issues. The purpose is to develop critical and creative

thinking skills so they are better able to address these issues throughout their lives. Students use FPSP-CPS to explore challenging scenarios and apply an action plan to address complex issues. Teams are first provided with a topic and are given time to research it and practice the stages of FPSPI. After having researched a given topic, having analyzed the given Future Scene, the students produce an FPSPI booklet that contains team responses to prescribed FPSPI prompts. There are five topics or booklets that can be completed during a year if a team progresses to the final round. The FPSP-CPS process is used to complete the practice problems (PP1 and PP2), one qualifying problem (QP), and the problems for the state and international competitions.

The international program is comprised of state or regional Affiliate groups. In FPSP-GIPS, for the first practice problem (PP1), only the first half of the booklet and only the first 3 steps of the FPSP-CPS process are completed in the form of a booklet. For PP2 and the QP, the full booklet, including all six steps, is completed and scored by trained evaluators. Teams are then provided with formative scores using the FPSPI rubric, as shown in Appendix A, as well as suggestions for improvement for PP1 and PP2. The QP booklet is scored summatively to qualify for the state or regional Affiliate FPSPI Bowl, where top scoring teams are then invited to compete. Winning teams from the Affiliate Bowl advance to compete at the international competition in June (Future Problem Solving Program International, 2012a).

Treffinger and Jackson (2012) described the FPSP-CPS as a practical application of CPS using a specific, linear process. The FPSP-CPS process has some steps emphasizing both generating and focusing while other steps emphasize one phase over the other. In the FPSP-CPS process, a task is given to the students with the expectation that CPS is

appropriate and students are expected to use it. The FPSP-CPS process assumes that teams will use all steps and that they will do so in sequence. In the FPSP-CPS process, while other tools may be used in practice, there is a strong emphasis on brainstorming in competition. The FPSP-CPS process focuses on quantity and quality. When evaluating options FPSP-CPS relies primarily on one tool, an evaluation matrix that limits the options ranked to eight.

Collaboration and Teamwork. Collaboration and teamwork represent another important foundation for FPSPI. In an interview (Cramond, 2001), Torrance described the purpose of FPSPI as a deliberate effort to improve educational processes by preparing students for both innovative and creative careers. He argued that CPS provides students with a set of tools they can apply to solve problems. In addition, he explained the rationale for the emphasis on the collaborative process in FPSPI saying, “When teams include people of varied perspectives, ideas combine and combust in interesting ways” (p. 32).

Collaborative learning is a process in which students learn by working together, yet group process is not evaluated by the teacher, as in cooperative learning (Bruffee, 1995). Grounded in social constructionism (Bruner, 1996; Dewey, 1916; Piaget, 1973; Vygotsky, 1978), collaborative learning is concerned with the creation of knowledge where the teacher acts as a facilitator (Ornstein & Hunkins, 1998). It is a social-intellectual exercise that involves the creation of new knowledge whereby a problem is posed and a solution is sought (Brody, 1995; Bruffee, 1995). The goal of the group is to generate the best possible solution through creative interaction (Brody, 1995). The goal of the process is to solve abstract problems that have no specific answers or have multiple solutions. Throughout the process, the governance of the students is placed in the hands of the students (Olivares, 2005).

Klein et al. (2009) examined the effectiveness of team building in relation to team performance outcomes. The median team size was nine. Team building effectiveness was analyzed ($n = 579$) as were 26 independent effect sizes. A comprehensive review of relevant literature was conducted and coded into 14 categories. Effect sizes were weighted by considering the size of the sample and were used to determine the influence of team size on the ability of team building training to improve the functioning of the team.

The effect sizes from the studies were categorized into three groups based on size: small, medium, and large. Small groups were groups that had fewer than five members. There were seven effect sizes analyzed from a total of 178 teams. The true score correlation was $\hat{\rho} = .28$. Medium groups had between five and 10 members. There were 10 effect sizes analyzed from a total of 340 teams. The true score correlation was $\hat{\rho} = .27$. Large teams had more than 10 members. There were nine effect sizes analyzed from a total of 61 teams. The true score correlation was $\hat{\rho} = .66$. The results showed that team building was the most effective with large teams.

Team building was determined to be effective for four outcomes: cognitive, affective, process and performance. Thirty-nine correlations were meta-analyzed as to the impact of the combined set of the four outcomes using 10 effect sizes from 258 teams, where the true score correlation was $\hat{\rho} = .37$, suggesting a moderate effect of the combined set of team outcomes. The impact of team building on cognitive outcomes was analyzed using 3 effect sizes and 71 teams. The true score correlation was $\hat{\rho} = .13$. The impact of team building on affective outcomes was analyzed using 19 effect sizes from 482 teams. The true score correlation was $\hat{\rho} = .44$. The impact of team building on process outcomes was analyzed using 20 effect sizes from 485 teams, resulting in a true score correlation where $\hat{\rho} = .44$. The

impact of team building on performance outcomes was analyzed using 18 effect sizes from 52 teams, with a true score correlation was $\beta = .26$.

In addition, effect sizes were used to meta-analyze the impact of team building on interpersonal relations, problem solving and goal setting. There were 13 effect sizes from 140 teams were used to analyze interpersonal relations and the true score correlation was $\beta = .26$. There were 11 effect sizes from 326 teams used to analyze problem solving and the true score correlation was $\beta = .24$. In addition, 5 effect sizes from 54 teams were used to analyze goal setting and the true score correlation was $\beta = .35$.

The analysis determined that team building had an effect on four outcomes: cognitive, affective, process, and performance. Team building had a positive effect on interpersonal relations, problem solving, and goal setting.

While this study examined team effectiveness in relation to performance outcomes, a second study showed the benefits from team skills training over time. Prichard, Bizo and Stratford (2006) studied whether or not team skills training could enhance performance in collaborative learning groups. The quasi-experimental study took place over the course of two semesters with intact groups of undergraduate students in their second year of an honors psychology program. The first cohort ($n = 94$) received no team skills training. The second cohort ($n = 113$) received team skills training for one semester. The third cohort ($n = 88$) received team skills training during the first semester, but the groups remained intact throughout the next semester after the training.

There was a significant main effect of cohort on student grades $F(2, 271) = 45.16, p < .001$ with students who received team training skills outperforming students who did not receive such training. In addition, there was a significant interaction between cohort and

semester for mean grades $F(2, 271) = 5.78, p < .01$. Post hoc comparisons using a Scheffé procedure revealed that the mean grades for cohorts two and three were significantly higher than the mean grades for cohort one ($p < .01$), and there was a significant decrease in grades for cohort two between semesters one and two, $t(110) = 2.68, p < .01$. The grades for cohort three showed no significant differences across semesters $t(73) = 1.15, p > .05$. An analysis of team skills showed a significant main effect for time $F(1, 258) = 25.63, p < .001$. Cohorts two and three showed a significant increase in scores across the two semesters (cohort two, $t(98) = 3.08, p < .01$, cohort three, $t(85) = 3.72, p < .001$). The mean percentage of increase for cohort one was 3.3%, for cohort two was 7.2%, and for cohort three was 12.1%.

Cohesion ratings for phase two were analyzed using an ANOVA. There was a significant main effect for cohort $F(2, 222) = 13.53, p < .05$, a significant main effect of semester $F(1, 222) = 26.75, p < .05$, and a significant interaction between semester and cohort $F(2, 222) = 3.35, p < .05$. Post hoc Scheffé tests showed that cohesion scores in the first semester were higher in cohorts two and three than in cohort one ($p < .05$). In the second semester, cohesion ratings in cohort three were higher than in cohort one ($p < .05$). There was no significant difference between cohorts one and two, and between cohorts two and three. There was a significant reduction in cohesion between semesters one and two for both cohorts two and three (cohort two $t(84) = 5.23, p < .001$, cohort three $t(55) = 2.80, p < .05$). There were no significant differences across semesters for cohort one. The results supported the use of team skills training to enhance performance; however the author suggested that the benefits of the training may be lost if the groups do not remain intact.

A third study concerning the effects of teamwork was used to analyze collaborative learning and academic performance. Nihilani, Wilson, Thomas and Robinson (2010), using a

mixed method design, examined the relationship between performance, team composition, and peer evaluations. Students ($n = 101$) from a large southwestern university participated. There were 18 teams with 5-7 members per team. The analysis included what were deemed superstar scores (the highest individual score for each team) and superstar difference scores (the difference between the highest scoring group member and the mean scores of the rest of the group).

The qualitative results showed that low performing teams had an individual who dominated the discourse, while high performing teams demonstrated a joint effort by individual team members who worked collaboratively on group tasks. The quantitative results showed that both the superstar difference scores and the superstar scores were shown to be reliable predictors of group performance.

The quantitative results showed that the model accounted for 81.9% of the variance in team achievement $F(6, 93) = 70.34, p < .001$. Superstar difference scores were a negative predictor of group level academic grades $\beta = -.287, p < .001$, and superstar scores had a positive effect on team scores $\beta = .220, p < .001$. It was concluded that a factor in slowing team cohesiveness was teams with dissimilar levels of individual academic performance.

While collaborative learning has been effective in terms of increasing academic performance with the general population, Varvel, Adams, Pridie and Ulloa (2004) studied whether or not training about personality type enhanced team performance. Participants ($n = 188$) were enrolled in a one or two semester senior design class in an engineering college at a midwestern university. This quasi-experimental study included one treatment and one comparison group. The treatment included one hour of training one month into the study. It included an explanation of type preference using the Myers-Briggs Type Indicator: how

individuals with certain type preferences tend to react in certain situations, and preferences, strengths, and weaknesses of each type.

Instrumentation included the Myers-Briggs Type Indicator, academic grades in the senior design class, and the scores from the Team Effectiveness Questionnaire (TEQ). The TEQ was divided into two parts. The first part included demographic information, preferences about teamwork, and previous team experience. The second part measured the ability to work effectively in teams and seven characteristics that have been identified as vital for team performance. There were significant differences between the treatment group and the comparison group with the treatment group outperforming the comparison group in performance $F = 4.263$; $p = 0.043$, communication $F = 4.452$; $p = 0.039$, interdependence $F = 7.854$; $p = 0.007$, psychological safety $F = 5.100$; $p = 0.028$, and attitude $F = 11.323$; $p = 0.001$. Results indicated that training on personality type helped team members improve communication, trust and interdependence. These results seemed to reinforce the value of team training because students who worked in teams and were trained in personality type demonstrated significantly better performance and process skills than those students who were not trained.

Impact and Effectiveness of the Future Problem Solving Program International

Five studies analyzed the impact and effectiveness of FPSPI. First, Cramond, Martin and Shaw (1990) examined whether or not students participating in FPSPI had the ability to generalize their training to other contexts. Gifted students ($n = 75$) in grades 6-8 with no prior experience with CPS participated in the study.

Groups were randomly assigned to one of three groups for this study with two experimental groups and one control group ($n = 25$). The first experimental group ($n = 28$)

received traditional CPS training and the second experimental group ($n = 25$) received CPS training infused with strategies intended to enhance the transfer of learning to other contexts. The training consisted of 40 minutes of instruction in CPS and FPSPI twice a week for 8 weeks. Students in the second experimental group received the same training as those in the first group plus an added component. These students also received additional training about the types of problems for which CPS is most effective to use, as well as other processes besides CPS. This group also engaged in frequent discussions about the benefits and applicability of CPS.

The posttest involved a problem solving task that included three real-world problems where CPS was appropriate to use and three real-world problems where CPS was not appropriate to use. A calculation of the percentage of students in each group exhibiting problem solving behaviors from a structured observation sheet allowed for a Chi-Square analysis.

Results showed that the transfer training group had the highest percentage of students who applied problem solving strategies, followed by the CPS group, and then the control group ($p < .05$). Significant differences among groups existed regarding the application of CPS $F(2,75) = 3.86, p < .05$. A post hoc test showed that the CPS transfer group applied problem solving procedures significantly more frequently than the control group, with no difference in the application of CPS between the CPS-only group and the control group. The positive benefits of a CPS curriculum on students, as well as benefits for students using a version of CPS in the FPSPI program, suggests the potential of the FPSPI program to support the development of students' creativity.

Second, Czerwiec (1992) analyzed the perceptions about the FPSPI program of coaches ($n = 46$) and students ($n = 513$) in grades 4-12 who were involved in FPSPI. Most of the participants (71.9%) were in the Junior Division (grades 4-6), with 47.6% of the sample in grade 5. In addition, 25.0% of the students were in the Middle Division (grades 7-9) and 3.1% were in the Senior Division (grades 10-12).

Coaches met with students during the school day, after school, and during the evenings for a total of 2-4 hours a week, with a mean of 1.56 hours per week of meeting time. Coaches and students completed separate surveys about FPSPI. Other instruments used in the study were a demographic questionnaire, a questionnaire about the perception of the impact of FPSPI on student skills, and essay questions about FPSPI.

The results showed that FPSPI coaches believed the strengths of the program were: critical thinking and the FPSPI process (62.6%), teamwork and group effort (51.1%), creativity (26.7%), and having topics that affect students (24.4%). Weaknesses or challenges of FPSPI, as determined by the coaches, were difficulties with deadlines and with meeting after school (27.3%), difficulty with the FPSPI process (18.2%), concerns about the evaluation including negative comments and subjectivity (13.6%), and lack of funding (11.4%). Factors that were considered strengths of FPSPI as determined by the students were: teamwork (22.5%), competitive bowls (18.9%), knowledge gained (17.2%), learning about the future (17.2%), creativity (17%), thinking skills (14.5%), making a difference in the world (13.9%), and communication skills (13.2%). Students disliked the time commitment (23%), the amount of work (21.3%), and had difficulty with the process (16.1%). Others found it boring (13%) or expressed concerns with team issues (10.9%).

The study showed the strengths of FPSPI as perceived by coaches as supporting critical thinking, teamwork and group effort, and creativity, and having a topic that affects students. The strengths of FPSPI as perceived by students were developing teamwork, participating in competition, gaining knowledge, learning about the future, utilizing creativity, developing thinking skills, making a difference in the world, and strengthening communication skills.

A third study by Tallent-Runnels (1993) analyzed the effects of FPSPI in a quasi-experimental study of fourth and fifth grade gifted students in 12 elementary schools in one suburban district ($n = 61$). Some subjects in the gifted program volunteered to participate in FPSPI ($n = 33$), while the remaining students did not participate in FPSPI ($n = 28$). Three trained evaluators scored the FPSP-GIPS booklets. An ANOVA was used to analyze the data. Students in both the comparison and treatment groups participated in the FPSP-GIPS problem by completing team problem booklets that evaluators scored in six different areas: problem identification, statement of the problem, alternative solutions, evaluation of solutions, statement of the most promising solution, and elaboration of the final plan to gain acceptance of the solution.

The treatment group significantly outperformed the comparison group in four of the six areas analyzed: problem identification $F(1,57) = 17.72, p < .005, w^2 = .15$, problem statement $F(1,57) = 27.67, p < .005, w^2 = .31$, alternative solutions $F(1,57) = 30.11, p < .005, w^2 = .33$, and evaluation of solutions $F(1,57) = 20.24, p < .005, w^2 = .24$. There was a significant overall effect for the treatment on the total scores $F(1,57) = 26.31, p < .005, w^2 = .30$.

In a fourth investigation of FPSPI, Buckmaster (1994) conducted a qualitative study using action research in a gifted program with seventh grade students ($n = 28$) who participated in FPSPI with additional activities to support teamwork. The researcher analyzed the results of student surveys, questionnaires, an evaluation, team preference sheets, student interviews, and a teacher daily journal.

The survey was administered three times during the year. Students rated their feelings about themselves, their teacher, their relationship with others, and the class in general on a 5-point Likert-type scale. There were five additional open-ended questions. The researcher asked the students to express what was positive, negative and interesting about the team problem-solving process. Teammate preference sheets included questions asking students for input on team members for each of the three problems. There was team fluidity in the sense that the students were not part of the same team all year. Five students were interviewed after all of the activities were completed. The teacher journal was used to record perceptions of feelings, classroom atmosphere, and student attitudes.

The researcher found mixed results with both positive and negative effects of the new activities administered on teamwork, group dynamics and cohesiveness. While 98% of the students enjoyed the activities, and 78.6% identified themselves as creative thinkers, 38% of the responses of what they learned about others were negative. Students reported that they enjoyed working in teams, yet they had negative perceptions about teamwork and team dynamics. Half of the students disagreed that they could now resolve conflicts better as a result of participation in the program, yet all students stated they would like to compete again if allowed the opportunity. The mixed results for students in FPSPI in terms of teamwork,

group dynamics, and cohesiveness, suggested a need to explore team process further in the context of the FPSPI program.

Fifth, Kurtzberg and Reale (1999) analyzed FPSPI as part of a middle school curriculum for the purpose of studying if the teacher of the FPSPI increased creative output in students. Participants ($n = 43$), ages 13 and 14, were part of two eighth grade heterogeneous physical science classes in a suburb in the northeast. This experimental study involved random assignment to class with equivalent ages, sex, academic aptitude, and achievement in each group. The instrumentation used was the FPSPI booklet and a pretest that examined scores for fluency and flexibility. Reliability was determined by having the booklets randomly selected and scored by 5 senior FPSPI evaluators in New York State; scores between evaluators differed by less than 2% for the same booklet. The two most senior evaluators, each with a minimum of 3 years of scoring experience, scored the pretests and posttests.

The results of the posttest showed there was a significant difference between the treatment and comparison groups with the treatment group outperforming the comparison group in the number of problems produced ($p < .01$), the number of relevant problems produced ($p < .01$), the number of different categories produced ($p < .001$), and the total score ($p < .001$). These results indicated that teaching FPSPI contributed significantly to creative output specifically in terms of number of problems, number of relevant problems, number of different categories, and total score.

The Emerging Role of Problem Solving Style

Given the research about collaborative learning, instruction about problem solving styles when engaged in a creative problem solving team has the potential to enhance

performance in FPSPI. Problem solving styles are consistent differences in the way individuals perform generating and focusing activities as well as an individual's disposition towards problem-solving, influenced by mindset, engagement and attitudes (Selby et al., 2007). Style is a way to understand how individuals differ in expressing their creativity. It refers to how a person is creative, as opposed to how creative one is (Isaksen et al., 2011). Studies related to problem solving style with respect to: CPS, creative thinking, and FPSPI lead to the need for the current study.

Selby, Treffinger, Isaksen, and Lauer (2004) examined the construct of problem-solving style in relation to assessment of individuals using VIEW: An Assessment of Problem Solving Style (VIEW). Isaksen and Tidd (2006) explained that VIEW can be used to promote teamwork by providing insight into individual style preferences so that strengths may be utilized. Because working outside an individual's problem solving style preference requires extended energy, individuals with diverse problem solving styles can complement one another (Isaksen & Tidd, 2006).

Three dimensions are assessed by VIEW: Orientation to Change (OC), Manner of Processing (MP), and Ways of Deciding (WD). In the OC dimension, there are two styles, Explorer and Developer. Individuals with an Explorer style tend to be unconventional, view structure as confining, emphasize originality, bend rules, and challenge authority (Selby, Treffinger & Isaksen, 2011). Personal implications for individuals who have an Explorer preference are that they: tend to prefer to work away from direct supervision; see deadlines as fluid; are energized when they have a wide variety of tasks; work best without structure and authority; and enjoy creating their own rules and guidelines (Selby et al., 2011). The benefits for individuals with this style are that they take an unpredictable approach, depart

from traditions and provide new ways of doing things, help others understand the big picture, provide different options to consider, ask the question, “Why?” and question assumptions (Selby et al., 2011). Individuals who have an Explorer preference may be more likely to be perceived, especially by individuals with a Developer preference, as unsound, impractical or abrasive. These individuals may need to be challenged to work out the details, and may find it difficult to be aware of, and to deal with, current realities. They may overwhelm others with their ideas or may challenge a tradition without considering its value. In addition, they may be impatient with people who either demand details or ask for assurances of success (Selby et al., 2011).

Individuals who have a Developer style tend to want to find ways to do things better; enjoy and see the benefits of structure; enjoy working within stated rules; are seen as precise, thorough, and dependable; and tend to emphasize usefulness (Selby et al., 2011). Personal implications for individuals who have a Developer style preference are that they may feel enabled when working with the guidance of authority, and they may welcome rules, seek deadlines, be persistent, and be energized by the details of the implementation (Selby et al., 2011). Individuals who have a Developer style preference provide stability, order and continuity to a group. They take a step-by-step approach and make options more workable and understandable and tend to provide a safe foundation for decisions and emphasize precision, accuracy, and thoroughness to problem solving (Selby et al., 2011). Those with a Developer preference may need to be made aware that they are more likely to be viewed by Explorers as timid, rigid or inflexible. These individuals may need challenge to search for ideas outside of current practices and may find it difficult to look towards a desired future. They may be unaware when group process is blocked by structure, authority and rules, as

they may over focus on how things are done as opposed to why they are being done. In addition, they may feel impatient when questions are kept open after a decision has been reached (Selby et al., 2011).

In the MP dimension there are two styles: External and Internal. When solving problems, individuals who have a clear External style preference tend to derive energy through interacting with others. They prefer to engage in a variety of tasks as well as discussions of possibilities. In addition, they tend to share their ideas freely with a broad range of people, and press for action while seeking input from others (Selby et al., 2011). Personal implications for individuals who have an External style preference are that they may prefer sound in the work environment, engagement with others, and learning through discussion (Selby et al., 2011). Benefits for individuals who have an External style preference may be the following abilities: to look for different perspectives, respond quickly, and initiate communication with others. These individuals are energized when working in a group. People who have an External preference need to be aware that they are more likely to be seen by those with an Internal preference as overeager or lacking in depth of analysis. They may tend to share ideas before they are complete and may need to be challenged to listen to the ideas of others (Selby et al., 2011).

People who have an Internal style preference in the MP dimension may be energized by reflection and may look for quiet opportunities for concentration. They may share ideas with others after thinking them through or after establishing trust and confidence, and may think before acting but may sometimes not act at all (Selby et al., 2011). Personal implications for individuals who have an Internal style preference are that they may prefer to process information privately becoming engrossed with inner ideas. They may work with

one approach at a time; by observing or reading, and they may prefer to remain in one place (Selby et al., 2011). Benefits of this style preference may include the ability to look deeply into tasks, thinking through new ideas until they are fully formed before sharing. They may be able to steer a group away from outside pressures, and to help people who have an External style preference listen (Selby et al., 2011). Individuals who have an Internal style preference are more likely to be seen by those with an External preference as secretive, aloof or detached. They may find it challenging to act without having adequate time for reflection and may need to be challenged to share their thoughts and ideas even if they are not fully formed. In addition, they may get so caught up with their internal processes that they may not notice what is going on around them (Selby et al., 2011).

In the WD dimension, there are two styles: Person-Focused and Task-Focused. Individuals who have a Person-focused style tend to promote harmony and have positive interpersonal relationships. They tend to think of ideas as being connected with the person and use criteria that are more subjective, personal, and sensitive to people's feelings. They also tend to consider the personal impact when a decision is made or try to find what is pleasing about an option. They seek options that promote buy-in from all involved and may put people's feelings first sometimes at the expense of the quality of the outcome (Selby et al., 2011). Individuals who have this style preference may attend to relationships more than an individual with an Explorer preference, in that they seek harmony over outcomes. They may tend to avoid conflicts, sometimes to their own detriment. They may overlook facts as a way of maintaining harmony (Selby et al., 2011). Benefits to individuals who have a Person style preference are that they may offer sensitivity to the group. They also may help others understand feelings and emotional implications of decisions. They may tend to make sure

people are comfortable prior to moving ahead with a decision and may make efforts to ease conflicts in a group situation. They may contribute subjective criteria to a group when making decisions and may affirm new ideas being considered (Selby et al., 2011). These individuals may need to be aware that they are more likely to be seen by others as allowing their own preferences as well as the preferences of others to influence their decision-making. They may run the risk of being so focused on people that the need to obtain results is neglected. They may avoid sharing negative aspects of ideas and may become so attached to their concern for others that they are unable to separate themselves from the task (Selby et al., 2011).

Individuals who have a Task-focused style preference may tend to focus on what is logical, react to ideas as separate from an individual person, use criteria that are more objective, find what is lacking or what is needed with a particular option, and seek the best solution. They may put the quality of the outcome above people's feelings (Selby et al., 2011). Personal implications for people who have a Task style preference may be that they tend to prefer impersonal judgments, and they may tend to address conflicts at the expense of the feelings of others. They work persistently towards the achievement of outcomes, and they may focus on facts and ignore emotions. They may also prefer to communicate about what is wrong or needs improvement about a particular option without providing positive feedback (Selby et al., 2011). Benefits to individuals who have this particular style preference may be that they bring reason to a group. They may be able to help others understand the logical implications of a decision and may be able to push a group to achieve outcomes. They may bring sensitive issues out into the open. They also may contribute objective criteria when making decisions and may be able to point out critical elements or

areas in need of improvement when considering options (Selby et al., 2011). People who have a Task preference may need to be made aware that they are more likely to be seen as unconcerned or willing to hurt people's feelings. They may be focused on outcomes to the detriment of important interpersonal issues and concerns. They may provide critical analysis that may discourage other individuals with new ideas, and they may be detached from a decision so others are unable to see their enthusiasm (Selby et al., 2011).

Isaksen and Tidd (2006) assert that problem solving style differences are not deficits but that these differences can be used to complement a team composition. The diverse ranges of experiences and perspectives of group members strengthen a group's ability to learn. Teams, as defined by Isaksen and Tidd (2006), represent individuals who must collaborate and share both the responsibility and the accountability for obtaining results.

Treffinger, Selby and Isaksen (2008) stated that when individuals have an understanding of their own problem solving style, they are then able to learn and apply CPS tools more effectively, and when teams understand the styles of each individual member, problem solving effectiveness is improved. The researchers also believe VIEW can be used to help people recognize, describe, and appreciate problem solving preferences, guide individuals to develop creative strengths and talents, and enhance communication and collaboration. More research is needed to determine how knowledge of personal style and competence with CPS can help individuals perform at high levels.

Problem Solving Style and Creative Problem Solving

Isaksen and Geuens (2007) determined the extent of enjoyment and usefulness of CPS and VIEW according to participants involved in the Cognitive Styles project. This exploratory study involved participants ($n = 81$) from an Igniting Creative Potential course in

North America that was based on CPS version 6.1™. Instrumentation included VIEW and a CPS survey of 33 questions involving the level of enjoyment in learning CPS and the extent of the use of CPS tools, guidelines and stages.

A multivariate analysis of variance (MANOVA) was used to analyze the OC dimension and the overall results from the survey. There was a significant interaction between OC and the CPS survey results, $F(16,55) = 338.16, p < .001$. Post hoc tests showed that participants with an Explorer preference had significantly higher levels of enjoyment as measured by the CPS survey in the areas of understanding the challenge ($p = .03$) and planning approach ($p = .03$), compared with participants with a Developer preference. In addition, those with an Explorer preference that they had significantly higher levels of use of generating ($p = .02$), focusing tools ($p = .04$), understanding the challenge ($p = .01$), preparing for action ($p = .023$), and planning your approach ($p = .01$).

A MANOVA was used to analyze the MP scores and the overall results of the CPS survey. There was a significant interaction between the MP dimension and the CPS survey results, $F(16,55) = 308.22, p < .0001$, with individuals with an External preference reporting higher levels of enjoyment in the following subtests of the survey: striving for quantity, using affirmative judgment, and staying on course, as compared to those with an Internal preference. When these items were collapsed, there were no significant differences between those with an External preference and those with an Internal preference.

A MANOVA was also used to analyze the WD scores and the results of the CPS survey. There was a significant interaction between the dimension of WD and the CPS survey, $F(16,55) = 328.87, p < .0001$. Individuals with a Task preference reported significantly higher levels of enjoyment of learning the generating guidelines ($p = .02$) and

generating ideas ($p = .05$) when compared to those with a Person-oriented preference.

Individuals with a Task preference also demonstrated significantly higher levels of use of generating tools ($p = .05$), focusing tools ($p = .03$), generating ideas ($p = .04$), and planning approach ($p = .04$) than those with a Person-oriented preference. These results demonstrated that problem solving style interacts with the learning and application of CPS and that VIEW can assist in helping individuals understand their preferences for the different components of CPS.

Problem Solving Style and Creative Thinking

Houtz and Selby (2009) analyzed the relationship between creative thinking and problem solving style. Participants ($n = 65$) included graduate and undergraduate students enrolled in three different psychology classes. Instrumentation included: VIEW, the TTCT-Figural version, and a Problem-Solving Inventory (PSI). PSI measures confidence and affective control during the problem solving process.

Results showed there were no significant correlations among the three VIEW dimensions (ranging from $-.009$ to $.194$) or the PSI subtests (ranging from $.102$ to $.246$). This was consistent with VIEW and PSI theory as these constructs are independent. There were significant correlations within the TTCT-Figural between TTCT-Figural, Fluency and originality ($r = .62, p < .01$), elaboration ($r = .49, p < .01$), and resistance to premature closure ($r = .51, p < .01$). In addition, there were significant correlations between TTCT-Figural, Originality and both elaboration ($r = .35, p < .05$) and resistance to premature closure ($r = .40, p < .05$). There were also significant correlations between TTCT-Figural, Elaboration and resistance to premature closure ($r = .40, p < .05$). There were no VIEW or PSI scores that correlated significantly with TTCT-Figural in the areas of fluency, originality

or elaboration. In addition, none of the dimensions of VIEW correlated significantly with any of the PSI subscales. There was a significant correlation between resistance to premature closure on the TTCT-Figural with the OC and WD dimensions of VIEW ($r = -.385$, $r = .369$, $p < .05$) with Explorers and Person-oriented deciders being more resistant to closure. These results reinforced the construct validity of VIEW and gave further clarity the relationship between creative thinking and problem solving style.

Woodel-Johnson, Delcourt, and Treffinger (2012) also explored the relationships between problem solving style and creative thinking abilities. The study involved participants ($n = 105$) in grades 9-12 enrolled in 3 similar high schools. Instruments used in the study were: VIEW; TTCT-Verbal, Form B; and TTCT-Figural, Form B. There were no significant correlations between creative thinking (Ways of Deciding, Verbal Fluency, Verbal Flexibility, Verbal Originality, Verbal Total Average, Figural Fluency, Figural Originality, Figural Titles, Figural Elaboration, Figural Resistance, Figural Total Average) and problem solving style in any of the 3 dimensions of VIEW: Orientation to Change (OC), Manner of Processing (MP) and Ways of Deciding (WD). This demonstrated the independence of creative level and problem solving style, contributing again to the construct validity of VIEW as a measure of problem solving preference.

Problem Solving Style and the Future Problem Solving Program International

Treffinger (2008) investigated style differences among participants in various components of FPSPI as compared to adolescents in a VIEW database. Participants were coaches ($n = 46$) and students ($n = 196$) who were part of the FPSPI international conference. FPSPI-GIPS participants were in the Middle Division ($n = 68$), Senior Division ($n = 54$) and individual ($n = 14$). Community Problem Solving participants were in the Middle Division

($n = 29$), Senior Division ($n = 14$) and individuals ($n = 2$), and Scenario Writing participants were in the Middle Division ($n = 3$) and Senior Division ($n = 6$). All participants were administrated VIEW.

Results showed that similarities existed in FPSPI participants in all three dimensions: OC, MD and WD. There was a significant difference in FPSPI males ($M = 67$, $SD = 14.5$) and females ($M = 73.8$, $SD = 16$) in the OC dimension $t = 2.68$, $p < .05$ that was similar to the profile of adolescents in the master data base for the Center for Creative Learning. There were no other significant differences in either MP or WD with regard to gender. There was also a significant difference between Middle Division ($n = 110$) and Senior Division ($n = 80$) FPSPI students in the WD dimension, ($M = 37$, $SD = 8.0$), $t = 2.61$, $p < .05$, with Senior Division participants demonstrating a significantly a greater Task preference than a Person-oriented preference. In addition, FPSPI students who participated as individuals ($n = 25$) ($M = 36$, $SD = 7.2$) showed a significantly greater Internal preference in the MP dimension, as opposed to an External preference, than those who participated in FPSPI as part of a team ($n = 165$) ($M = 30$, $SD = 10.2$); $t = 2.83$, $p < .05$). Students who participated in FPSP-GIPS ($M = 29$) showed a significantly greater External preference, as opposed to an Internal preference, than students who participated in Community Problem Solving (CMPS) ($M = 33$) in the MP dimension ($t = 2.22$, $p < .05$).

While VIEW scores for students involved in FPSPI in the OC dimension were similar to adolescents in the Center for Creative Learning database, there were differences in the MP and WD dimensions. Participants who worked on a team had a higher External preference than Internal preference while those who chose to work individually had a higher Internal preference in the MP dimension. FPSPI participants had a significantly higher Task

preference than adolescents in the Center for Creative Learning database. These results suggest that the population of adolescents who volunteer to be part of FPSPI may be slightly different from the population at large in terms of problem solving style.

Treffinger (2006) explored problem-solving styles in an experimental study with middle and senior level teams from FPSPI in Florida. The teams were randomly assigned to either the experimental or comparison group with 22 senior level teams (10 experimental and 12 comparison) and 13 middle level teams (7 experimental and 8 comparison). Students in the experimental group, as well as their coaches, had completed VIEW at the beginning of the program.

The coaches received feedback about their results and attended a presentation about VIEW. The researcher provided individual reports for each of the team members to the coaches to share with their groups. This information included the implications of VIEW results on potential team relationships, with comments, suggestions, and information about strengths and limits of various style preferences in relation to the stages of FPSPI.

Students in both the experimental group and the comparison group participated in FPSPI and completed the Practice Problems 1 and 2 (PP1 and PP2) and the Qualifying Problem (QP). The students were also administered a researcher-created Teamwork Skills Inventory (teammate and self-assessment) and a 7-item teamwork questionnaire.

There was a significant negative correlation between PP1 scores and QP scores ($r = -0.32, p < .01$) yet there was a significant positive correlation between PP2 and QP scores ($r = 0.23, p < .05$). On the QP, the mean score for the comparison group ($M = 255.8$) was significantly higher than the treatment group ($M = 238.5, F(1,27) = 3.19, p < .09$). There was a significant negative correlation with teamwork scores and PP1 scores ($r = -0.24, p <$

.05), QP scores and the self-assessment ($r = -0.34, p < .01$) and QP scores and the teammate assessment ($r = -0.50, p < .01$). The comparison group scored significantly higher ($p < .05$) than the treatment group in 7 out of 9 of the indicators on the teamwork (teammate) posttest and on four indicators including the total score on the self-assessment posttest. The results showed that students who were given information about their problem solving styles did not have higher posttest scores than students who did not receive this information. Although the results in this study favored the comparison group, the teams did not necessarily remain intact throughout the study that may have impacted the results. In addition, the students in the treatment group did not receive training about their style as the information given was limited to VIEW scores and understanding VIEW. The implications of this study influenced the design of the current study.

The Rhodes model of creativity (1961) involves the use of person, process, product and press (environmental or situational pressures). Murdock and Puccio (1993) argued that the use of this construct in defining creativity can increase the generalizability of research findings. Using the Rhodes model, *person* can be defined as one's problem solving style, *product* as the production of an FPSPI booklet, *process* as CPS, and *press* as the collaborative learning environment of FPSP-GIPS teams. The potential benefits of training about problem solving style guided by VIEW results for participants involved in FPSPI formed the basis for the proposed study.

CHAPTER THREE: METHODOLOGY

This study examined the following research questions:

1. Is there a significant difference in Future Problem Solving Program Global Issues Problem Solving scores between students who are trained in understanding and applying their problem-solving styles and students who do not receive training about their problem-solving styles?

Non-directional hypothesis: There will be a significant difference in Future Problem Solving Program Global Issues Problem Solving scores between students who were trained in understanding and applying their problem-solving styles and students who do not receive training about their problem-solving styles.

2. To what extent and in what manner will variation in Future Problem Solving Program Global Issues Problem Solving scores be predicted by fluency, flexibility, and originality scores on the *Torrance Test of Creative Thinking-Verbal*, after accounting for participation in Future Problem Solving Program group membership?

Directional hypothesis: Fluency, flexibility, and originality scores on the *Torrance Test of Creative Thinking-Verbal* will not significantly predict Future Problem Solving Program Global Issues Problem Solving scores after accounting for differences in Future Problem Solving Program group membership.

3. What are the students' perceptions of their working relationships as members of a Future Problem Solving Program Global Issues Problem Solving team?

The researcher selected a non-directional hypothesis for Research Question 1 given the results of Treffinger (2006) in contrast to the previous researcher. A directional hypotheses was chosen with only group as the factor accounting for differences in group membership because the research on creativity level and style (Isaksen, 2004) supported that creativity might not be a factor.

A description of the methodology used for the present study follows. This chapter includes a biography of the researcher, a description of the subjects and setting, the sampling procedure used, the research designs, and instrumentation used. It presents a description of data analyses conducted, the data collection procedures, and the timeline. Descriptions of the treatment, the limitations, and an ethics statement also provide more detail.

Biography

In addition to being a doctoral candidate in Instructional Leadership at Western Connecticut State University, the researcher works as an elementary school principal. She has served as a K-4 instructional specialist in the area of mathematics and writing as well as a K-5 teacher of the gifted, a K-5 math support teacher, and a pilot assessor for the National Association for the Education of Young Children (NAEYC). In addition, she worked as a classroom teacher for eleven years in grades K, 1, 2, and 5. The researcher holds the following degrees: a Certificate of Advanced Study in educational leadership from Sacred Heart University, a Master's of Science in Early Childhood and Elementary Education from Bank Street College, and a Bachelor's of Arts in English from Cornell University. Her master's thesis was about nurturing creativity and creative development. Prior to beginning this study, she completed Qualified VIEW user training in April, 2012 and participated in

the FPSPI evaluator training in October, 2012.

Setting

The research took place in a suburban high school that participates in the Global Issues Problem Solving (GIPS) component of the Future Problem Solving Program Affiliate using a sample of convenience. The high school was one of six schools (4 elementary, 1 middle school and 1 high school) in a suburban public school district with a total student population of 3,542. The town population was 23,035 with 14.3% of adults without a high school diploma. The per capita income was \$29,919. The high school enrollment was 1,186 students. The high school identified 9.9% of the student population as gifted and talented and the gifted program offered at the high school was FPSPI. Data about the school were obtained through the public state database. See Table 1 for specific school demographics.

Table 1

High School Demographics

Category	Number of Students	Percentage of Students
Free/Reduced Lunch	107	9.9
Not Fluent in English	9	0.8
Identified as Gifted/Talented	118	9.9
Identified as Disabled	101	8.5
Juniors and Seniors Working 16+ Hours or More Per Week	104	20.4
Total Minority	258	21.8
American Indian	3	0.3
Asian American	75	6.3
Black	70	5.9
Hispanic	84	7.1
White	928	78.2
Two or More Races	25	2.1

Participants

The subjects included 75 student participants and in grades 9-12. There were 32 males (42.7%), 43 females (57.3%), and one male coach. This was a sample of convenience based on the fact that most FPSPI groups in the state are spread throughout a large geographical area. Students were in the FPSPI Middle Level (Grade 9) and Senior Level (Grades 10-12.) There were two groups, the treatment group ($n = 35$) who received training

in problem solving styles and the comparison group ($n = 40$) who did not receive training in problem solving styles. The semi-structured interviews involved purposeful sampling and included participants ($n = 15$) from 4 teams, one from each grade level and two from the treatment group and two from the comparison group.

The students in the treatment group had an average of 3.4 years of experience with FPSPI with the students in grade 9 having had an average of 2.3 years of experience, and the students in grade 11 having had an average of 4.3 years of experience. The students in the comparison group had an average of 3.6 years of experience with FPSPI with the students in grade 10 having had an average of 2.5 years of experience, and the students in grade 12 having had an average of 4.8 years of experience.

Accessible Population

Students in the accessible population were all identified as academically gifted by the district. The coach served as both a teacher of the gifted as well as the coordinator of gifted and talented for the district. The teacher of the gifted teacher/coordinator was a part-time position (.6). He also served as a high school social studies teacher (.4).

The district identification of students who are gifted and talented begins in grade four and students are reevaluated in grade eight based on the district's identification process. Parents, faculty, peer or self-nominations are part of this process as well as state testing results and academic grades. Identification is ongoing between grades 3-12.

State law mandates that districts identify students with extraordinary learning ability or having outstanding talent in creative arts; however, the state does not require districts to offer programs for identified students. The district in the accessible population offers gifted programming in grades 4-12.

Program for students in grades 4-8 takes place either before or after school and involves participation in FPSPI as well as in other activities. The high school program is exclusively the FPSPI program and is conducted during school hours for students in grades 9 and 10 and before school for those in grades 11 and 12.

In grades 9-12, FPSPI is offered as a course for credit and is open only to students identified as gifted. Students in grades 9 and 10 participate in the course for 90 consecutive minutes twice a week and receive 1 credit for the course. The grade 10 course is a social studies course and includes instruction in skills related to the State writing test. The students in grades 11 and 12 meet before school once a week for 45 minutes and receive .5 credits. This course is considered a semi-independent study.

Sample

The researcher established that equivalence between the groups based on number of years of experience with FPSPI would be preferred over randomization of group assignment to treatment or comparison conditions since participants were part of intact classes already in progress. The unit of analysis was the students.

Consent and assent were received from 92.59% of the population solicited in grades 9-12. Of the students in grades 9 and 11, 100% of consent and assent were received. The consent and assent forms are shown in Appendices B-F). In grade ten, 90.91 % were received, and in grade twelve, 83.33% were received. The coach commented that some of the seniors were overloaded with the expectations required of them in their last year of high school, and therefore chose not to participate. The number of participants per grade level and FPSPI level are described in Table 2.

Table 2

Frequencies for Accessible Population and Participants by Grade Level

Grade Level	FPSPi Division	Accessible Population	Participants	Percentage of Participants from Accessible Population
9	Middle	15	15	100
10	Senior	22	20	91
11	Senior	20	20	100
12	Senior	24	20	83

Sampling Procedures

Selection of teams for the treatment and comparison groups was done by balancing age, grade level, and years of experience with FPSPI. Consideration was also given to the amount of time students were in class as well as balancing the structure of the program. There was a discrepancy in the amount of class time the grade 9 and 10 students participated in FPSPI and the length of time grade 11 and 12 students participated. The former were scheduled for 82-minute sessions (two back-to-back classes) every other day, while the latter had 45 minutes (one before school session) once per week. To try to compensate for these differences in time available for the program on a weekly basis, teams of grade 9 and 11 students ($n = 35$) were organized for the treatment condition and teams of grade 10 and 12 students ($n = 40$) were created for the comparison group. The groups are compared in Table 3 with respect to program meeting times.

Table 3

Meetings of FPSPI Groups

Group	Grade	Class Length	Time of Day	Frequency
Treatment	9	82 minutes	During school	Every other day
Comparison	10	82 minutes	During school	Every other day
Treatment	11	45 minutes	Before school	Once per week
Comparison	12	45 minutes	Before school	Once per week

The treatment group ($n = 35$) had a mean age of 15.7 with a range of 13.83 to 17.00 years, and the comparison group ($n = 40$) had a mean age of 16.6 with a range of 14.75 to 18.25 years. One tenth grade student participated in the eleventh grade course and for the purposes of this study is considered an eleventh grader. The mean years of experience in FPSPI for all participants was 3.49 years ($SD = 2.11$). An ANOVA was conducted to establish group equivalence based on the number of years of experience with FPSPI. The comparison group had a mean number of years of experience of 3.58 ($SD = 2.24$) with a range of 1-9 years of experience. The treatment group had a mean number of years of experience of 3.40 ($SD = 1.99$) with a range of 1-6 years. There was no significant difference between groups in mean number of years of experience with FPSPI ($F(1,73) p = .126$). See Table 4 for a description of the groups.

Table 4

Description of Groups

Group	Grade Level	Number of Teams	Average Age	Number of Team Members	Average Years of FPSPI Experience
Treatment	9 and 11	9	15.7	35	3.4
Comparison	10 and 12	12	16.6	40	3.6

The participants were part of 21 FPSP-GIPS teams in one suburban high school in Connecticut. The number of members of each team ranged from 3-4 with some members of some teams choosing not to participate in the study. Nineteen teams had four total team members with four of these teams having three participants in the study, and one team with two participants in the study. Two teams had three total team members with all team members participating in the study. The ninth grade had four teams, the tenth grade had six teams, the eleventh grade had five teams, and the twelfth grade had six teams. See Table 5 for a description of the number of participants on each team.

Table 5

Number of Participants on Each Team

Teams	Number of Team Members	Number of Participants in Study
Grade 12: Comparison Group		
1	4	3
2	4	4
3	4	3
4	4	4
5	4	3
6	4	3
Total 6	24	20
Grade 11: Treatment Group		
7	4	4
8	4	4
9	4	4
10	4	4
11	4	4
Total 5	20	20

(continued)

Table 5

Number of Participants on Each Team

Team Numbers	Number of Team Members	Number of Participants in Study
Grade 10: Comparison Group		
12	4	2
13	4	4
14	4	4
15	3	3
16	4	4
17	3	3
Total	6	22
Grade 9: Treatment Group		
18	4	4
19	4	4
20	4	4
21	3	3
Total	4	15
Grand Total	21	81

One certified teacher coached all 21 teams. He had 34 years of public school teaching experience as a history teacher and 28 years of experience as an FPSPI coach. His state certification is in grades 7-12 history and social studies. He stated that the factors that contributed to his success as a coach were the length of time he has been coaching, his personal interest in many topics, and his personal interest in the future and in science fiction. He said, “I think that my love for what I do, concern about my students, and being a little competitive makes this anything but a job. It is also great to learn about so many different topics and have new things to explore every year.”

Students self-selected their teams and the coach acknowledged that groups tend to be based on social relationships. The coach stated that even if teams are not successful, they tend to remain intact for this reason.

Sample Selection for Quantitative Analysis

The participants ($n = 75$) were the same students for both the quantitative and qualitative analyses. All participants in the treatment group ($n = 35$) completed VIEW. All participants completed PP2, and a total of 74/75 participants completed QP. A total of 74/75 completed TTCT-Verbal.

Sample Selection for Qualitative Analysis

For the qualitative analysis, all participants were asked to complete a questionnaire. A total of 74/75 questionnaires were received. Purposeful sampling was utilized for follow-up semi-structured team interviews. A total of 15 participants were interviewed.

Regarding the team interviews, a freshman, sophomore, junior and senior team was selected so that there were 2 teams from the comparison and the 2 teams from the treatment group. Each team was from a different grade level. Teams with four members were

selected (as opposed to teams with three members) as well as teams where all members were participants in the study, as opposed to teams of three or teams with at least one member who was not a participant in the study. PP2 and QP scores were used for the selection process. A four-person team from the treatment group and the comparison groups were selected so that each group had a team with PP2 and QP scores $>$ than 100 and PP2 and QP scores $<$ 100.

None of the Grade 12 teams with 4 participants in the study had a QP score $<$ 100, and one team from Grade 10, Team 16, had a PP2 score of 99 and a QP score of 94. This team was selected for the interview from the Comparison group. Of the two Grade 12 teams comprised of 4 members, only one team, Team 2, met the criteria for having both PP2 and QP scores $>$ 100. This team was selected for the interview.

For the treatment group, only one team had a QP score $<$ 100, Team 10. No treatment group teams had PP2 scores $<$ 100. Team 10 was selected as being the closest to the set of criteria as was possible. A Grade 9 team was needed from the Treatment group with PP2 and QP scores $>$ 100. All three four-person teams met this criterion. A randomizer tool, random.com, was used to make this selection. Team 20 was chosen for the interview. One team was selected in addition to the above criteria, because one of the participants was absent the day of the QP and did not complete the questionnaire. See Table 6 for the PP2 and QP scores of each team with 4 participants in the study.

Table 6

Teams with Four Participants Considered for Semi-Structured Interview

Team Number	Grade	PP2 Score	QP Score	Selected for Interview
Comparison Group				
2	12	118	102	Yes
4	12	93	102	No
13	10	107	116	No
14	10	113	106	No
16	10	99	94	Yes
Treatment Group				
7	11	112	128	No
8	11	111	111	No
9	11	109	122	No
10	11	101	97	Yes
11	11	114	117	No
18	9	111	100	No
19	9	113	116	No
20	9	112	115	Yes

Audit. The data were audited by an experienced qualitative researcher. The researcher created an audit trail and documented all decisions made (Given, 2008). An auditor reviewed the data collection and analysis trail retroactively to confirm rigor.

The researcher sent the auditor all qualitative data as well as a copy of the dissertation. Definitions of the themes were also provided. The auditor provided a brief reporting about agreement with the meaning of the coding terms as well as the codes themselves. There were no disagreements with the researcher's decisions, and therefore no reconciliations were needed.

Coding agreement was done by selecting 3 sections of 50 codes using an online randomization tool. The auditor viewed lines 700-749, 800-849, and 950-999 as determined through the randomization process. The researcher explained the logical sequence for coding patterns (codes, categories, and themes) and reviewed the triangulation of results, conclusions and implications of the data. The auditor prepared a written report of the review as shown in Appendix G. There was 100% agreement between the researcher's coding and the auditor's coding.

Instrumentation

A total of nine instruments were used in this study. Five of the instruments were qualitative measures (two Demographic surveys, one for the coach and one for the students; a Coach's Log; a Questionnaire; and Semi-Structured Team Interviews) and four were quantitative (Global Issues Problem Solving: PP2 and QP; VIEW; TTCT-Verbal).

Demographic Surveys

Demographic information was collected from both the coach (19 items) and the students (14 items) using researcher-created instruments that are displayed in Appendices H-

I. The coach's survey included identification information, gender, amount of teaching and coaching experience, information about times and days team(s) met, willingness to keep the team(s) intact for the duration of the study, and a commitment for the teams to be available for a two-hour training session. The student survey included identification information (name, date of birth, sex, school, town, grade) and contact information, as well as years of experience with FPSPI.

Coach's Log

This researcher-created instrument was to provide a vehicle for the coach to record lesson activities for the purpose of monitoring the fidelity of the treatment. The coach designated whether the team was part of a VIEW group (treatment) or Research group (comparison) at the top of the log. The log prompted the coach to include the date, duration, specific activities and notes for each lesson. A blank log is shown in Appendix J.

Questionnaire

The purpose of this researcher-created instrument was designed using the theory of symbolic interaction (Bogdan & Biklen, 2007) that is based that individuals interpret the behavior of others and then behave based on this interpretation. The 8-item questionnaire was used to assess the problem solving process used by students while in their respective teams. The questions were piloted by the researcher with students in a similar creative problem-solving program that allowed for further refinement of the instrument. There are 8 questions containing 2 subscales: team and self. Questions include items about strengths and weaknesses of the team and individual, how conflicts were handled and what was learned in the process that may be applicable to other situations. The questionnaire is presented in Appendix K.

The Questionnaire took approximately 20 minutes to complete. Coding was done both by comparing all students using two cycles of codes which produced categories and themes (Bernard & Ryan, 2010; Corbin & Strauss, 2008; Saldaña, 2013).

Semi-Structured Team Interviews

The purpose of the semi-structured team interviews was to further explore data gleaned from the questionnaire. The team interviews were conducted by the researcher and each was approximately 20 minutes in length. The semi-structured interview had 12 questions that were asked by the researcher. The questions are included in Appendix L. Questions were designed based on the results of the questionnaire and the participants were asked to self-report their observations about their experience with FPSPI, team and individual strengths, how conflicts were resolved within the team, and how their experience with FPSPI may or may not apply to other areas of their lives.

Sessions were recorded using audio and transcribed by a private contractor who specializes in transcriptions. Transcripts were sent to participants one week after the team interviews for member checking to insure trustworthiness (Toma, 2006).

Global Issues Problem Solving: Practice Problem 2 and Qualifying Problem

The purpose of the Global Issues Problem Solving Practice Problem 2 (PP2) was to provide formative feedback to participants after participating in an initial phase of the Future Problem Solving Program Global Issues Problem Solving (FPSP-GIPS) curriculum. The purpose of the Global Issues Problem Solving Qualifying Problem (QP) was to determine that teams would be invited to the state competition.

Topics were given in advance and students were encouraged to research with their team. The topic for the PP2 was Robotics Age, and the topic for the QP was Megacities for

2012-13 when the research took place. Teams of 3-4 students then completed the PP2 and the QP without assistance from their coach and recorded their results in an FPSPI booklet. All teams completed their booklets within a two-hour time constraint.

The PP2 (pretest) and the QP booklets were scored by two independent raters who were trained FPSPI evaluators using the program criteria. The evaluators were blind with respect to the research study.

The GIPS rubric that is shown in Appendix A contains both quantitative and qualitative feedback for the participants. Improvement of student work is the primary goal of the evaluation process so that feedback can be provided to develop and improve the problem solving process.

The quantitative data consisted of six subscales (Step1, Step 2, Step 3, Step 4/5, Step 6, and Overall) with 27 items in all (FPSPI, 2012b). The purpose of Step 1 (Identify Challenges) is for the team to problem solve within the boundaries of the Future Scene. Step 1 has 4 items scored (Fluency, Flexibility, Clarity, and Originality) with the total score ranging from 3-30 with the possibility of more points for originality.

The purpose of Step 2 (Selecting an Underlying Problem) is for the team to identify an important part of the Future Scene to solve. The total score for Step 2 ranges from 2-30.

Creating varied and unusual ideas as a response to the Underlying Problem is the purpose of Step 3 (Produce Solution Ideas). The total score for this subscale ranged from 3-30 with extra points allowed for originality.

Steps 4 and 5 are combined to create a total score. The purpose of Step 4 (Generate and Select Criteria) is to write the criteria that measure the solution ideas to set the standard for judging. The purpose of Step 5 (Apply Criteria to Solution Ideas) is to develop a matrix

to evaluate that solution to use to develop an action plan. The total score for Steps 4 and 5 ranges from 1-25.

The purpose of Step 6 (Develop an Action Plan) is to develop an action plan and to explain its relevance in relation to the Underlying Problem and the Future Scene in general. The total score for Step 6 ranges from 5-40.

The purpose of the Overall score is to measure the combination of the research and creative problem solving process from the Future Scene through the Action Plan. The total for this subscale ranges from 3-30 (FPSPI, 2012b). All subscales are added together to create a composite score, ranging from 17-185 with more points possible for originality (FPSPI, 2012b).

The composite score was the dependent variable used in this study with the PP2 as the pretest and the QP as the posttest. For both of these tasks, the students were given the topics in advance of the competition for the purpose of researching the subject prior to completing the booklet.

VIEW: An Assessment of Problem Solving Style

VIEW: An Assessment of Problem-Solving Style (Selby et al., 2002) is an assessment of problem solving preferences. The respondent is asked to judge the behavior that is most comfortable and natural when solving problems (Treffinger et al., 2007).

Problem-solving styles are consistent individual differences in the ways people prefer to plan and carry out generating and focusing activities, in order to gain clarity, produce ideas, and prepare for action. An individual's disposition towards change management and problem solving is influenced in part by mindset, willingness to engage in and respond to a situation as

presented, and the attitudinal dimensions of one's personality. Preferences are natural leanings that support productivity. (Selby, et al., 2011, p. 1-2)

Individual differences are viewed as strengths and the assessment is built on the idea that understanding problem solving styles will allow people to use diversity constructively and work to apply strengths in creative problem solving and when managing change (Treffinger et al., 2007).

The assessment is based on psychological theory and research about personality, individual differences, and meta-cognition (Treffinger et al., 2007). It draws from the following theories and research: psychological type, cognitive type, learning style, creativity style, innovation, change management, psychology of the person and Creative Problem Solving (Selby, et al., 2011).

There are 34 statement pairs in all with 1-7 points for each item that “present positive expressions of a well-established preference” (Selby, et al., 2011, p. 1-2). The constructs that are assessed are considered to be bipolar with both statements being balanced in terms of their social desirability with strengths and benefits in each of the styles when dealing with problem-solving situations or managing change (Selby et al., 2011). Three dimensions are assessed: Orientation to Change (OC) that contains 18 items, Manner of Processing (MP), that contains 8 items, and Ways of Deciding (WD) that contains 8 items.

The assessment is appropriate for administration to groups of individuals between the ages of 12- adult. It takes approximately 10-15 minutes to complete, though there are no time limits. The respondents are asked to think about what is natural when reading the two statements. Feedback is given to the respondent either individually or as a group by a Qualified VIEW user after completion of the assessment (Selby et al., 2011).

Dimensions. There are three dimensions assessed by VIEW: Orientation to Change (OC), Manner of Processing (MP), and Ways of Deciding (WD). The OC dimension has a continuum of style preferences ranging from two seemingly opposite styles: Explorer and Developer (Treffinger et al., 2007). The OC dimension assesses an individual's preference when dealing with change or solving problems for: structure, novelty and authority. In the OC dimension, the scores range from 18 to 126 with a hypothetical mean of 72. The mean from a VIEW database ($n = 27,548$) is 74.2 (Treffinger, 2010) with lower scores representing an Explorer style preference and higher scores representing a Developer style preference. The median is 75, the mode is 72, and the standard deviation (*SD*) is 15.8 and the standard error of measure is 5.70 (Treffinger, 2010).

The MP dimension assesses a continuum of preference between External and Internal (Treffinger et al., 2007). The dimension of MP measures a preference for managing and sharing information and interacting with others when problem-solving. The scores range from 8 to 56 with a hypothetical mean of 32. The mean from the database is 29.3 (Treffinger, 2010) with lower scores representing an External style preference and higher scores representing an Internal style preference. The median is 29, the mode is 32, the standard deviation is 9.1, and the standard error of measure is 3.40 (Treffinger, 2010).

The WD dimension assesses style preferences on a continuum of Person focus and Task focus (Treffinger et al., 2007). The WD dimension measures an individual's preference for emphasizing task concerns and personal needs when moving toward decisions and action, with scores ranging from 8 to 56 with a hypothetical mean of 32. The mean from the database is 35.3 with lower scores representing a Person style preference and higher scores

representing a Task preference. The median is 36, the mode is 32, the standard deviation is 8.4, and the standard error of measure is 3.36 (Treffinger, 2010).

Moderate scores. Individuals with moderate scores, those who are within one standard deviation of the mean for any dimension, may act in a group situation in a role that serves to bridge between the two styles. For those with moderate style preferences, their responses to problems and challenges may vary in relation to the task and the nature of the makeup of the group with which they are working. When in a group with people whose responses are split between the two extremes or where the group dynamics are skewed towards one preference, the individual with the moderate style may be perceived as a person with the opposite preference from the others in the group (Selby et al., 2011).

Validity and Reliability. Reliability and validity of VIEW is well-established. The reliability (Cronbach's Coefficient Alpha), is .87 for the OC dimension, .86 for the MP dimension, and .84 for the WD dimension (Treffinger, 2010). Construct validity has been established through multiple studies (e.g., Houtz, 2002; Selby, Shaw, & Houtz, 2003). There is an annotated bibliography of validity and reliability studies (VIEW, 2013). Correlations with other instruments, test-retest reliability and internal consistency have also been studied (Selby, et al., 2007).

Torrance Test of Creative Thinking-Verbal, Form A (TTCT-Verbal)

The purpose of this test is to measure a constellation of generalized mental abilities that increase the chances that a person will behave creatively (Torrance, 2008). High degrees of ability as measured by the TTCT increases the likelihood that an individual will behave creatively (Torrance, 2008). The test was developed over 50 years ago and has been used in more than 2,000 research projects (Torrance, 2008).

The instrument takes 45 minutes to administer. The TTCT-Verbal battery contains 7 timed (5-10 minutes each) activities: Asking, Guessing Causes, Guessing Consequences, Product Improvement, Unusual Uses, Unusual Questions, and Just Suppose.

Scores were obtained using the 2007 norms (Torrance, 2008). The scoring results were reported in standard scores ranging from 40-160 in three norm-referenced measures (fluency, flexibility, originality) as well as a composite score. Fluency represents the respondent's ability to produce a large number of relevant responses (excluding nonsense or inappropriate responses). Flexibility represents the ability to shift, use a variety of strategies or produce a variety of ideas. The originality score was based on the respondent's ability to produce unique, uncommon, or statistically infrequent ideas (Torrance, 2008).

Reliability and validity is well established (Kim, 2011b; Torrance, 2008). Scoring for this project was done by trained personnel of Scholastic Testing Service, who produced grade and age-related norms that consist of standard scores and a national percentile for each of the subscales (fluency, flexibility and originality), an average standard score for the composite, and a national percentile rank for the composite score (Torrance, 2008). Inter-rater reliability was studied using two trained scorers. Coefficients of 0.99, 0.95, and 0.98 were found for fluency, flexibility and originality scores, respectively (Torrance, 2008).

Permission was obtained to use this test in a dissertation. The coach administered the assessment to the students according to the test protocol after receiving training from the researcher to insure standardization in administration. TTCT-Verbal was chosen over the TTCT-Figural version because of its similarity in content to FPSP-GIPS booklets and focus on verbal output or responses.

Research Designs and Data Analyses

The research design was a mixed method using a convergent parallel design (Creswell & Plano-Clark, 2011). The unit of analysis was the student.

Data relating to the first research question were analyzed using a quasi-experimental design. The independent variable was the type of program for students in FPSPI. Participants took part in either a program that included training in problem-solving styles as well the activities related to the FPSPI process (treatment) or they were involved with only the regular FPSPI program (comparison). The dependent variable was the posttest for FPSPI called the QP score. To reduce the possibility of a Type 1 error, significance was set at the .025 level, because data from the same sample were used in both Research Questions 1 and 2 (Meyers, Gamst, & Guarino, 2006). A one-way ANOVA was planned to analyze the results.

The second research question used a quasi-experimental design that utilized a multiple regression analysis. In order to assess participants' level of creative thinking ability, the TTCT-Verbal, Form A was administered to all students, and a hierarchical multiple linear regression procedure was conducted. The predictor variables were: type of program (treatment or comparison), placed in the first block, and followed by the set of predictors including fluency, flexibility and originality scores, entered in the second block. The criterion variable was the QP composite score. Significance was set at the .025 level (Meyers, et al., 2006).

For the third research question, a general qualitative design with two groups was used. A questionnaire was given to all participants concerning team and individual strengths and weaknesses, suggestions for improvements, and application of what was learned about self while working on a team. The unit of analysis was the individual ($n = 74$). One

participant did not complete the questionnaire. Follow-up semi-structured team interviews were conducted with selected teams ($n = 15$) using purposeful sampling with two teams from each group (comparison and treatment) and one team from each grade level. The criterion included teams with a total of four members all of whom were participants in the study. The researcher selected a team from the treatment group and the comparison group so that each group had a team with PP2 and QP scores $>$ than 100 and PP2 and QP scores $<$ 100. The researcher selected one of the teams because one of the participants was absent the day of the QP and did not complete the questionnaire. Of the two Grade 12 teams comprised of 4 members, only one team met the criteria for having both PP2 and QP scores $>$ 100.

The researcher needed a Grade 9 team from the Treatment group with PP2 and QP scores $>$ 100. All three four-person teams met these criteria. To select a team for participation, the researcher utilized an online randomizer tool which designated Team 20 as the team from this group to be interviewed. One team from the comparison group had both PP2 and QP scores less than 100, which met the criteria for selection. No team from the treatment group met these criteria. For the treatment group, only one team had a QP score $<$ 100, Team 10. No treatment group teams had PP2 scores $<$ 100. One team was selected as being the closest to the criteria as was possible.

Four team interviews of four person teams were conducted by the researcher, each lasting approximately 20 minutes. One participant was not present on the day of the interview. Participants self-reported their experience with FPSPI, team and individual strengths, how conflicts were resolved within the team, and how experience with FPSPI may or may not apply to other areas of their lives.

The qualitative data were analyzed using a cyclical process of coding. The first cycle involved an exploratory method using preliminary codes and a cyclical process of refinement (Saldaña, 2013). The researcher used both holistic coding to grasp the basic themes (Dey, 1993). For the second cycle, the researcher used pattern coding (Miles & Huberman, 1994) which allowed for synthesis into a more unified and organized scheme and linked seemingly unrelated data developing organization and categorization of concepts (Saldaña, 2013). Coding based on themes (Bernard & Ryan, 2010; Corbin & Strauss, 2008) was used to analyze the patterns in the data (DeSantis & Ugarriza, 2000).

Type of Data

Both quantitative and qualitative data were collected for this study. The demographic surveys were a mixture of categorical and qualitative data. PP2, QP, VIEW, and TTCT-Verbal were all continuous scores. Qualitative data were collected from the questionnaire, the Coach's Log, and the team interviews.

Data Collection Procedures

Data were collected from October 2012-June 2013 after the approval was obtained by the Western Connecticut State University IRB. There were delays in data collection caused by fallout from Hurricane Sandy that caused the completion of the QP to be delayed because of the exam schedule at the high school. The FPSPI scoring session was also delayed by one week because of a blizzard that produced 35 inches of snow (P. McCardle, personal communication, March 30, 2013). School closures from the blizzard also forced a slight delay in the administration of the questionnaire and TTCT-Verbal. The timeline for the study follows.

1. April, 2012 VIEW User Qualification Course completed;
2. October, 2012: Consent and Assent obtained using forms in Appendices B-F;
3. November 2012: Demographic Surveys completed, as shown in Appendices H and I, and teams assigned to groups;
4. November 30, 2012: PP2 completed;
5. December 3-7, 2012: Treatment group completed VIEW;
6. December 11, 2012 and December 13, 2012: Two ninety minute training sessions for treatment group completed by researcher;
7. December 14, 2012-January 28, 2013: Coach's Log completed using form shown in Appendix J;
8. January 28, 2013: QP completed;
9. February 20, 2013-February 21, 2013: Questionnaire completed using form shown in Appendix K;
10. February 22, 2013: Follow-up semi-structured team interviews conducted using questions in Appendix L;
11. February 26, 2013-March 5, 2013: TTCT-Verbal, Form A was administered;
12. March 22, 2013: FPSPI Affiliate State Bowl took place;
13. April, 2013: VIEW offered to interested comparison group participants;
14. May 29, 2013: VIEW training offered to interested comparison group participants;
15. June 6-9, 2013: FPSPI International Competition

Treatment

Both the students in the treatment group and the students in the comparison group participated in a course in Future Problem Solving as part of an elective at their high school. The researcher provided the students in the comparison group with supplemental research materials at the beginning of the treatment period. See Appendix M.

The students participating in the treatment and the coach completed VIEW in December, 2012. The researcher, a VIEW Qualified User, analyzed the results, and produced individualized reports for each of the participants about his or her problem-solving styles. The beginning of the treatment period consisted of one 90-minute training session. Training sessions were conducted for all participants in the treatment group ($n = 35$) with multiple teams participating in the same session. A total of two training sessions were held two days apart. The coach was also trained at the same time as the students and was present for both of the training sessions. The training began with an explanation of VIEW. Participants were provided with their scores and were invited to share them with their teammates. Four different activities were delivered, from a total of 21 choices that were selected based on the developmental age of the students. The activities selected were adapted from suggested activities in the VIEW Facilitator guide (Selby et al., 2011) and focused on understanding VIEW scores and working in groups with various style preferences. Activities used in the training are described in Appendices N-Q.

Training Session Preparation

The researcher worked with other Qualified Users to review the treatment to account for any issues so that the training would be transferable to other Qualified Users. Before the training started, contact was made with the coach to arrange for appropriate times for the

training sessions to occur. “What is your Style?” worksheets (one per participant) were prepared as well as individual 4-page reports, one for each participant including the coach. Materials for each of the four activities were collected and organized. VIEW scores were analyzed to create “Style Alike” groups for each of the training sessions in all six dimensions of VIEW. A Group Summary report for each FPSPI team was prepared for each participant and a copy of each team’s report was prepared for the coach. Finally, a worksheet was prepared for each participant for the “Team Slogan” activity.

Training Session Procedure

“VIEW Overview for Teams” (Selby et al., 2011), a 30-minute overview, was shared at the beginning of each session by the researcher followed by the “What is Your Style?” activity (See Appendix N). This section was presented in 45 minutes. “What is your Style?” worksheets were handed to each participant during the presentation prior to receiving the results of VIEW. The participants were asked to make a prediction about their score and give an explanation/example to justify their prediction after each of the three dimensions was explained.

Copies of the students’ “What is your Style?” predictions were collected after the session. Thirty-one sheets were collected. (Four students did not hand in a sheet). For 31 sheets with 4 VIEW dimensions, there would have been a maximum of 93 explanations; however, 4 explanations were left blank, and 1 was illegible. Of the 88 completed self-predictions, 64 of the numerical prediction estimates (72.7%) were relevant responses (i.e., the response related specifically to the content of the problem-solving style dimension) when compared to individual actual results. Students seemed to have a sense of their style even before VIEW training. VIEW scores and training confirmed this for the participants. Details

of the responses that were relevant to the content of the intervention are presented in Appendices R-T.

VIEW scores for the treatment group were analyzed by team to determine the amount of diversity in problem solving styles on each team. Three of the nine teams were found to have VIEW scores that varied among team members in all dimensions. Two teams were found to have similar OC and WD scores with a Developer and Task preference and varied MP scores. Two teams had similar WD scores with a Task preference and varied OC and MP scores among the team members. One of the teams had similar MP scores with an External preference, slightly varied WD scores and varied OC scores among team members. One team had similar OC scores among all team members with a Developer preference with varied MP and WD scores. See Table 7 regarding VIEW score patterns per team.

Table 7

VIEW Scores of Teams in Treatment Group

Team Number	OC	MP	WD	Description of Team Composite
7	85	41	42	Similar OC (Developer) and WD (Task); Varied MP
	97	29	40	
	112	50	46	
	80	40	38	
8	78	30	48	Varied VIEW scores in all dimensions
	60	23	29	
	102	38	42	
	67	34	39	
9	77	25	34	Similar OC (Developer) and WD (Task); Varied MP
	88	43	40	
	84	23	41	
	73	32	33	
10	54	42	51	Similar WD (Task); Varied OC and MP
	103	48	45	
	91	29	38	
	116	22	45	

(continued)

Table 7

VIEW Scores of Teams in Treatment Group

Team Number	OC	MP	WD	Description of Team Composite
11	30	33	25	Varied VIEW scores in all dimensions
	50	35	45	
	68	56	50	
	71	27	26	
18	76	23	36	Similar MP (External); Slightly varied WD; Varied OC
	77	25	26	
	48	20	22	
	57	8	33	
19	74	30	52	Similar WD (Task); Varied OC and MP
	95	19	42	
	68	25	33	
	73	46	40	
20	72	35	31	Varied VIEW scores in all dimensions
	74	40	40	
	102	36	40	
	67	27	30	
21	72	32	29	Similar OC (Developer); Varied MP and WD
	91	31	38	
	89	17	28	

Participants were then given their VIEW results by the researcher in the form of a 4-page report (Selby et al., 2011). The next 10 minutes were spent doing the “Signatures” activity as described in Appendix O. Participants were then asked to move to groups assigned by the evaluator to participate in “Style-alike Group Activity,” for 20 minutes as explained in Appendix P. The last 5 minutes were spent sharing the group summary for each team and preparing participants for “The Team Slogans Activity,” as described in Appendix Q. For this activity, the researcher handed out a copy of a worksheet that had the three VIEW dimensions, and individuals voluntarily shared their results with team members by marking their scores on the sheet. The researcher shared the range of scores for each team in relation to the continuum (Treffinger, 2012b) for each dimension as well as the range for moderate preferences. The worksheet also had a place for a team slogan, and blank lists for the team to record 3 team strengths, 2 team challenges, and 2 ways to leverage the strengths of the team for participants to complete at a later time.

In between training sessions, the researcher reviewed the results of VIEW by team with the coach. The mean scores for each team are presented in Table 8.

Table 8

VIEW Results: Mean Scores for Each Team

Team Number	Mean OC	Range OC	Mean MP	Range MP	Mean WD	Range WD
7	93.5	80-112	40.0	29-50	41.5	38-46
8	76.8	60-102	31.3	23-38	39.5	29-48
9	80.5	73- 88	30.8	23-43	37.0	33-41
10	91.0	54-116	35.3	22-48	44.8	38-51
11	54.8	30- 71	37.8	27-56	36.5	25-50
18	64.5	48- 77	19.0	8-25	29.3	22-36
19	77.5	68- 95	30.0	19-46	41.8	33-52
20	78.8	67-102	34.5	27-40	35.3	30-40
21	84.0	72- 91	29.7	17-32	31.7	28-38

The treatment period lasted for 9 weeks during that the coach provided lesson plans to the researcher to insure that information gleaned during the training session was not shared with the comparison group. The number of sessions per team varied based on the amount of contact time the class had as described in Table 3. The coach received VIEW scores by team and was encouraged to work with students in the treatment group, particularly when working with group process, using the information from the training session. This occurred 25% of the instructional time with students. The researcher also established regular contact with the coach during the treatment period as a support for the coach during this time.

Three t-tests were conducted to compare the mean scores obtained from the treatment group ($n = 35$) to the report by Treffinger (2012b) of the mean score in the VIEW database for FPSPI participants ($n = 438$) in each of the three dimensions. This was done to compare VIEW scores from the sample to VIEW scores of other FPSPI students in the population. After the data were cleaned, the VIEW data for the students in the treatment group ($n = 32$) were examined for normality using skewness (OC = $-.061$, MP = $.199$, WD = $-.242$) and kurtosis (OC = $.236$, MP = $.154$, WD = $-.571$). All three VIEW dimensions were in the acceptable range, which is less than + or -2 (D'Agostino, Belanger, & D'Agostino, 1990). Orientation to Change scores of the treatment group and the VIEW database of FPSPI participants did not differ significantly ($t = 1.55$, $p = .13$). Manner of Processing scores for the treatment group and the VIEW database of FPSPI participants also did not differ significantly ($t = 1.66$, $p = .11$). There was a significant difference ($t = 2.60$, $p = .01$, $d = .43$, medium) in Ways of Deciding scores between participants in the treatment group and the mean score of FPSPI participants in the VIEW database. This demonstrated that the

sample had more of a Task preference in the Ways of Deciding dimension than other FPSPI students in the population who have participated in VIEW. See Table 9 for a description of VIEW scores for the treatment group as compared to the FPSPI sample.

Table 9

VIEW Results for Treatment Group as Compared to FPSPI Sample

OC Mean	OC SD	MP Mean	MP SD	WD Mean	WD SD
Treatment Group					
77.7	18.5	31.7	10.2	37.6	7.8
FPSPI Sample					
72.9	16.0	28.9	9.9	34.2	8.0

Comparison Group

Participants in the comparison group were provided with the same FPSPI curriculum as students in the treatment group throughout the treatment period. Research links related to the FPSPI topic (Megacities) were prepared on a single sheet as a compensatory activity as shown in Appendix M.

Ethics Statement

The study was approved by the Institutional Review Board (IRB) of Western Connecticut State University. Participants were informed that they were able to withdraw from the study at any time. Data were confidential and were only available to the doctoral committee. All data were coded Data for VIEW were collected online and stored in the database using codes. VIEW feedback was given to the respondent individually and was not shared with other group members by the researcher, although all students in the

treatment group chose to share their VIEW scores with their teammates. Team interviews were recorded and transcribed by a professional. The transcriber was given pseudonyms to identify the speakers. Questionnaires and team interviews were coded and compiled without reference to specific individuals or teams. Quantitative data included codes and only aggregated information. TTCT-Verbal instruments were coded and assessed through a scoring agency.

CHAPTER FOUR:

ANALYSIS OF THE DATA AND AN EXPLANATION OF THE FINDINGS

The chapter includes an overview and explanation of the current study with a description of data collection as well as the analyses of the data. A detailed explanation of the analyses and results follows each research question.

Description of the Current Study

The researcher had three purposes of this study. First, the researcher attempted to determine if participation in training on problem-solving styles using VIEW (Selby, et al., 2007) had an impact on performance in creative problem-solving (scores in FPSP-GIPS) for students in grades 9-12. Second, the researcher analyzed the relationship between creative thinking ability, problem-solving styles training and performance in a creative problem-solving scenario. Third, the researcher analyzed differences in performance and process including perceptions about the creative problem-solving process regarding team and individual strengths and weaknesses by comparing students who learned about their problem-solving styles and those who did not.

The research took place in a suburban high school using a sample of convenience. The subjects ($n = 75$) included participants who were part of 21 FPSP-GIPS teams. The research design involved a mixed method using a convergent parallel design (Creswell & Plano-Clark, 2011) with the student as the unit of analysis. The researcher used a total of nine instruments in this study, five qualitative measures (two Demographic surveys, one for the coach and one for the students; a Coach's Log; a Questionnaire; and Semi-Structured Team Interviews) and four quantitative (Global Issues Problem Solving: PP2 and QP; VIEW; TTCT-Verbal).

Data relating to the first research question involved a quasi-experimental design with the independent variable as the type of program for students in FPSPI. The unit of analysis was the student. Participants took part in either a program that included training in problem-solving styles as well as the activities related to the FPSPI process (treatment) or the regular FPSPI program (comparison). The posttest for FPSPI called the QP score served as the dependent variable was. To reduce the possibility of a Type 1 error, the researcher set significance at the .025 level because data were used in both Research Questions 1 and 2 (Meyers, et al., 2006), and planned a one-way ANOVA to analyze the results.

The second research question used a quasi-experimental design that utilized a multiple regression analysis. In order to assess the degree of creative thinking ability attributable to the participants, the administration of the TTCT-Verbal, Form A was included all students. The analysis involved a hierarchical multiple linear regression procedure with the following predictor variables: type of program (treatment or comparison), placed in the first block, and followed by a second block with a set of predictors including fluency, flexibility, and originality scores. The QP composite score acted as the criterion variable. The researcher set significance at the .025 level (Meyers, et al., 2006).

For the third research question involved a general qualitative design with two groups. The researcher gave a questionnaire to all participants ($n = 74$) concerning team and individual strengths and weaknesses, suggestions for improvements, and application of what one learned about self while working on a team. Next, the researcher used purposeful sampling to conduct follow-up semi-structured team interviews with selected teams ($n = 15$). The analysis of the qualitative data involved a cyclical process of coding. The first

cycle involved an exploratory method using preliminary codes and a cyclical process of refinement (Saldaña, 2013) using holistic coding to grasp the basic themes (Dey, 1993). For the second cycle, pattern coding (Miles & Huberman, 1994) which allowed for synthesis into a more unified and organized scheme and linked seemingly unrelated data developing organization and categorization of concepts (Saldaña, 2013). Coding based on themes (Bernard & Ryan, 2010; Corbin & Strauss, 2008) was used to analyze the patterns in the data (DeSantis & Ugarriza, 2000).

The treatment period lasted for 9 weeks. The students participating in the treatment and the coach completed VIEW, and the researcher analyzed the results and produced individualized reports for each of the participants about his or her problem-solving styles. The beginning of the treatment period consisted of one 90-minute training session that began with a 30-minute overview of VIEW including the three dimensions. Participants made a prediction about their score and gave an explanation/example to justify their prediction after receiving an explanation of each of the three dimensions. This section took 45 minutes. The researcher provided participants with their scores in the form of an individual report and invited them to share them with their teammates. The next 10 minutes were spent by grouping students by style for each of the three dimensions. The last 5 minutes involved having each team create a slogan about their collective styles. The coach received a copy of VIEW scores by team and the researcher encouraged him to work with students in the treatment group, using the information from the training session throughout the treatment period.

The coach kept a Coach's Log throughout the treatment period to record activities with each group. The log provided a detail of the lesson plans for each of the groups throughout the treatment period.

Data Collection

The data collection involved 75 participants on 21 FPSPI teams. All participants in the treatment group ($n = 35$) completed VIEW. For the quantitative data, all participants completed PP2, and a total of 74/75 participants completed QP. A total of 74/75 completed TTCT-Verbal. The qualitative analysis involved all participants for the questionnaire and purposeful sampling for the follow-up semi-structured team interviews. The researcher received a total of 74/75 questionnaires, but one participant from Team 8 skipped question 8. The process of purposeful sampling based on the criteria identified by the researcher involved the selection of sixteen participants, fifteen of whom participated in the interview.

Data Analysis and Results

The analysis for data related to the quantitative research question includes an explanation of each assumption. The qualitative analysis describes the process used as well as an analysis of the data both within and between the responses to the questionnaire and interview.

Data Cleansing

As recommended by Meyers, et al. (2006), the researcher first conducted a visual inspection of the data, cleaned the codes and checked for any missing values. The creation of frequency tables and stem and leaf plots allowed for an efficient summarization of values to make sure all included the range for the scales used in the study.

Results of Research Question 1

The first research question was: Is there a significant difference in Future Problem Solving Program Global Issues Problem Solving scores between students who are trained in understanding and applying their problem-solving styles and students who do not receive training about their problem-solving styles? The non-directional hypothesis was: There will be a significant difference in Future Problem Solving Program Global Issues Problem Solving scores between students who were trained in understanding and applying their problem-solving styles and students who do not receive training about their problem-solving styles.

The researcher conducted an investigation of the assumptions for an ANOVA, normality, independence, and homogeneity of variance (Green & Salkind, 2008). The first step included an analysis of the pretest (PP2) scores regarding both groups, followed by an analysis of the posttest (QP) data.

Pretest Analyses

The original data set ($n = 75$) consisted of 40 students in the comparison group ($M = 104.88$, $SD = 11.37$) and 35 in the treatment group ($M = 108.97$, $SD = 5.94$). The researcher conducted an analysis of the assumptions for an ANOVA.

Assumptions. The researcher conducted an analysis of the PP2 pretest data for normality, independence, and homogeneity of variance.

Normality. The researcher analyzed the normality of the PP2 pretest data by examining skewness and kurtosis for both the treatment and comparison groups. The results for the original data found the skewness (treatment = -1.64, comparison = -1.48) and kurtosis (treatment = 1.55, comparison = 2.08) unacceptable.

The researcher then employed the use of box-and-whiskers plots because these can be helpful in revealing outliers (Tabachnick & Fidell, 2007). At this point, to further improve the normality, the researcher removed one outlier, team 3, with 3 participants in the comparison group. At this point, the treatment group included 35 participants ($M = 108.97$, $SD = 5.94$) and 37 in the comparison group ($M = 107.38$, $SD = 7.37$), resulting in improved skewness (-0.58) and kurtosis(-0.45) for the comparison group. D'Agostino et al. (1990) deem skewness and kurtosis which are less than + or -2 as appropriate for determining normality. The researcher performed a Levene's Test of Equality to test homogeneity of variance, finding significance ($p < .001$), and then deemed normality unacceptable.

Again, the researcher then employed the use of box-and-whiskers plots because these can be helpful in revealing outliers (Tabachnick & Fidell, 2007). This helped identify team 21, which had three participants from the treatment group, for removal. At this point, the treatment group included 32 participants ($M = 110.38$, $SD = 3.87$) and 37 in the comparison group ($M = 107.38$, $SD = 7.37$). With this removal, since skewness (treatment = -1.79, comparison = -0.58) and kurtosis (treatment = 2.27, comparison = -0.45) for the treatment group, the researcher determined this unacceptable.

To further analyze the normality, the researcher selected a Shapiro-Wilk test because of the size of the population and its power in determining departures from normality (Stevens, 2002). This test was significant for the treatment ($p < .001$) but not the comparison group ($p = .019$) (Meyer et al., 2006).

Czichos, Saito, and Smith (2011) states that homoscedasticity as more important than normality. Because of this, the researcher conducted a Levene's Test of Equality, finding it not be significant ($p = .93$).

While there were still concerns about the treatment group, the standard deviation was small ($SD = 3.87$), indicating the data were close to the mean. The next possibility would have been to eliminate another team from the treatment group, team 10, a team with four members. This team's score fell less than 2 standard deviations from the mean, which Hair, Anderson, Tatham, and Black (1998) deem as acceptable. Next, the researcher performed a visual analysis of the data using GAF posttests (Q-Q plots). The outputs for both the treatment and comparison groups are shown in Figure 1.

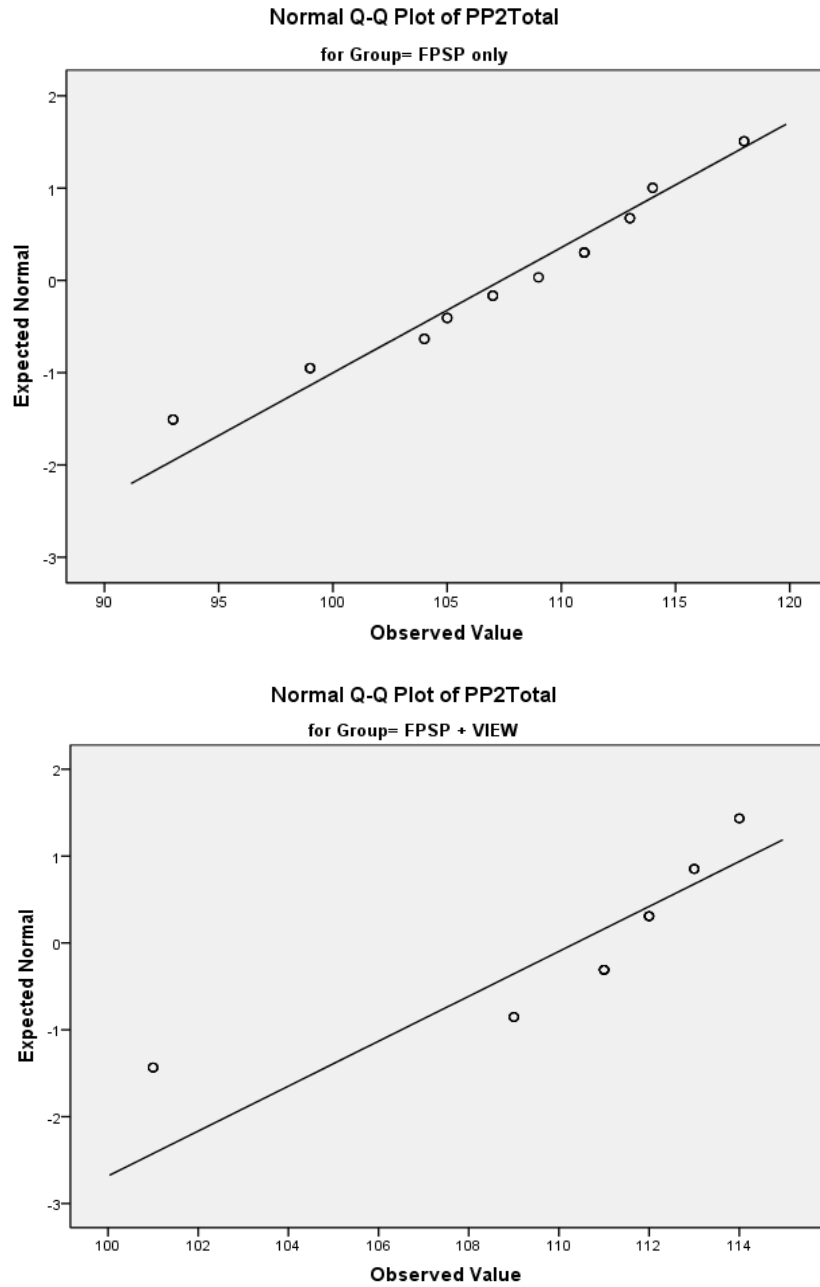


Figure 1. Q-Q Plots of GAF Posttests for Comparison and Treatment Groups

Statistics Solutions (2013) recommends that when a deviation from normality occurs, a more conservative p value should be used, specifically .01, when conducting tests for

significance. At this point, the researcher decided to leave the group intact and to reset the alpha level from .025, which was based on the Bonferroni correction, to .01.

Homogeneity of Variance. Since Czichos et al. (2011) view homoscedasticity as more important than normality, the researcher conducted an examination of homoscedasticity using Levene's Test of Equality of variances. The result ($p = .93$) was not significant since Tabachnick and Fidell, (2007) suggest a cut-off criterion of $p < .001$. This non-significant Levene's statistic indicated homogeneity of variance (Meyers, et al., 2006).

Independence. Two intact groups participated in the study, the treatment group and the comparison group. Since students participated as members of only one group, the researcher determined that the groups met the assumption of independence.

Results of the ANOVA. The researcher analyzed the PP2 scores were using an ANOVA to determine group equivalence and found the difference in PP2 scores between the treatment and comparison groups was ($F(1,67) = 4.273, p < .043$), with students in the treatment having higher initial scores than those in the comparison group. Refer to Table 10 for the means and standard deviations used in these analyses.

Table 10

Pretest Mean Scores and Standard Deviations as a Function of FPSPI instruction and VIEW training

	M (SD)	
FPSPI Instruction		
FPSPI + VIEW	110.38	(3.87)
FPSPI only	107.38	(7.37)
Mean	108.77	(6.15)

While this test statistic is significant at $p < .05$, using the recommendation of Statistics Solutions (2013), after applying a Bonferroni adjustment to account for having data collected from the same sample for two research questions, the researcher set the significance level at $p < .025$. Using this more conservative interpretation of significance meant the difference between pretest score means was not significant. Therefore, the researcher used the PP2 scores as a covariate, adjusting posttest scores for initial differences in the pretest scores.

Posttest Analyses

The data set ($n = 69$) consisted of 32 participants in the treatment group ($M = 113.25$, $SD = 9.93$) and 37 in the comparison group ($M = 105.14$, $SD = 9.61$). The researcher analyzed assumptions and conducted an analysis of covariance (ANCOVA).

Assumptions. The researcher analyzed the QP posttest data ($M = 108.90$) for normality, independence, and homogeneity of variance. The data set ultimately selected for analysis included 32 participants in the treatment group and 37 participants in the comparison group.

Normality. The researcher examined box-and-whiskers plots to reveal outliers (Tabachnick & Fidell, 2007). An analysis of skewness and kurtosis determined skewness (treatment = -0.38, comparison = -0.28) and kurtosis (treatment = -0.83, comparison = -0.95) as well within the acceptable limits for normality (D'Agostino, et al., 1990).

To further analyze the normality, the researcher selected a Shapiro-Wilk because of the size of the population. This test was not significant for the treatment ($p = .005$) or the comparison group ($p = .005$) as described by Meyers, et al. (2006).

Homogeneity of Variance. Next, the researcher analyzed homoscedasticity using the Levene's Test of Equality and found this value as not significant ($p = .93$), which indicated homogeneity of variance (Meyers, et al., 2006). At this point, the researcher decided to use this data set for analysis having met all three assumptions for an ANOVA (Green & Salkind, 2008), and conducted an ANCOVA.

Independence. The two groups remained intact throughout the study, an important factor for program stability because some FPSPI teams are known to have members who move from one team to another based on changing friendships over the course of an academic year. The researcher determined independence.

Results of the ANCOVA

To analyze the difference between the mean QP scores for both the treatment ($n = 32$) and comparison ($n = 37$) groups, the researcher used an analysis of covariance (ANCOVA) with two levels for the independent variable: participation in VIEW training along with FPSP-GIPS (treatment) and FPSP-GIPS only (comparison). The grand mean for the PP2 pretest was 108.77, and the grand mean for the QP posttest was 109.12, adjusted. Table 11 shows the mean and adjusted mean scores and standard deviations for both groups analyzed.

Table 11

Posttest Mean Scores and Standard Deviations as a Function of FPSPI instruction and VIEW training

Variables	M (SD)		Adjusted Mean
FPSPI Instruction			
FPSPI + VIEW	113.25	(9.93)	112.14
FPSPI only	105.14	(9.61)	106.10
Mean	108.90	(10.51)	109.12
Covariate (PP2)	108.77	(6.15)	

There was a significant difference ($F(1,66) = 7.44, p < .008$) between the mean QP scores for the treatment group ($M = 112.14$, adjusted) and the comparison group ($M = 106.10$, adjusted) with the treatment group outperforming the comparison group after controlling for PP2 scores, eta squared = .10, small. Table 12 shows the results of the ANCOVA.

Table 12

Analysis of Covariance of Posttest QP Scores as a Function of FPSPI Program and VIEW Training, With Pretest PP2 Scores as Covariate

Source	df	SS	MS	F	p	η^2
Covariate	2	2294.061	1147.031	14.524	.000	.306
FPSPI Program	1	229.709	229.709	2.909	.093	.042
PP2	1	1164.096	1164.096	14.740	.000	.183
Group	1	587.478	587.478	7.439	.008	.101
Error	66	5212.228	78.973			
Total	69	825770.000				

Program Outcomes

In the comparison group, 17% of the sophomores and 67% of the seniors, for a total of 47% had QP scores that qualified for the state competition. In the treatment group, 75% of the freshmen and 100% of the juniors, for a total of 89% had QP scores that qualified for the state competition. Two teams from the treatment group qualified for the international competition, while no teams from the comparison group qualified. One of those teams from the treatment group received sixth place at the international competition. Tables 13-14 show the outcomes for teams in the comparison group and the treatment group, respectively.

Table 13

Program Outcomes for Teams in the Comparison Group

Team Number	Qualified for State Competition	Award(s) at State Competition	Qualified for International Competition	Awards at International Competition
1	Yes	No	No	-
2	Yes	No	No	-
3	No	-	-	-
4	No	-	-	-
5	No	-	-	-
6	Yes	No	No	-
12	No	-	-	-
13	Yes	No	No	-
14	No	-	-	-
15	No	-	-	-
16	No	-	-	-
17	No	-	-	-
Total	4	0	0	

Table 14

Program Outcomes for Teams in the Treatment Group

Team Number	Qualified for State Competition	Award(s) at State Competition	Qualified for International Competition	Award at International Competition
7	Yes	1 st Place GIPS; 1 st Place Action Plan	Yes	Yes*
8	Yes	No	No	-
9	Yes	2 nd Place GIPS; Torrance Award	Yes	No
10	Yes	2 nd Place Action Plan Presentation	No	-
11	Yes	No	No	-
18	Yes	No	No	-
19	Yes	No	No	-
20	Yes	No	No	-
21	No	No	-	-
Total	8	5	2	1

Note. *6th Place GIPS Team at International Competition

The state competition results included two individuals in the treatment group selected to move to the international competition at the state competition, and no individuals in the comparison group. These results are shown in Table 15.

Table 15

Program Outcomes for Individuals in the Treatment Group

Part of Team Number	Qualified for State Competition	Award at State Competition	Qualified for International Competition	Award at International Competition
11	Yes	3 rd Place Individual GIPS	Yes	No
19	Yes	1 st Place Individual GIPS	Yes	No
Total	2	2	2	0

Unfortunately, since the teams did not necessarily remain intact between years, the researcher could not determine the outcomes of teams prior to the study. Also, in prior years, teams did not always remain intact within a given year. Teams remained intact during the current study as this was one of the criteria for inclusion in the study.

Results of Research Question 2

The second research question was: To what extent and in what manner will variation in Future Problem Solving Program Global Issues Problem Solving scores be predicted by fluency, flexibility, and originality scores on the *Torrance Test of Creative Thinking-Verbal*, after accounting for participation in Future Problem Solving Program group membership? The hypothesis was: Fluency, flexibility, and originality scores on the *Torrance Test of Creative Thinking-Verbal* will not significantly predict Future Problem Solving Program Global Issues Problem Solving scores after accounting for differences in Future Problem Solving Program group membership.

Descriptive statistics. Table 16 shows the mean creativity scores for each of the subtests of the TTCT-Verbal, Form A by group and overall.

Table 16

Mean Creativity Scores by Group

Group	TTCT-Verbal, Fluency	TTCT-Verbal, Flexibility	TTCT-Verbal, Originality
Treatment	111.7	114.9	124.5
Comparison	117.5	114.2	129.8
Total	114.7	114.6	127.3

Next, the researcher conducted an analysis of creativity scores by the outcome of the program with teams qualifying for the state championship and with teams that did not qualify. See Table 17 for these results.

Table 17

Mean Creativity Scores by Program Outcome

Group	TTCT- Verbal, Fluency	TTCT- Verbal, Flexibility	TTCT-Verbal, Originality
Qualified for State Competition	114.0	115.0	127.0
Did not Qualify for State Competition	115.5	113.4	127.8
Total	114.7	114.6	127.3

Next, the researcher reviewed the mean scores for each team in the study by creativity subtest. See Table 18 for these results.

Table 18

Mean Creativity Scores by Team

Team Number	TTCT-Verbal, Fluency	TTCT-Verbal, Flexibility	TTCT-Verbal, Originality
1*	111.7	96.3	129.0
2*	126.0	128.7	139.3
3	98.3	98.0	113.0
4	116.3	112.3	128.5
5	117.3	105.7	130.0
6*	106.0	108.0	116.3
7*	111.3	113.5	123.5
8*	95.8	100.8	109.8
9*	108.3	113.5	119.0
10*	109.5	118.0	124.0
11*	119.5	117.0	131.5
12	132.5	118.0	142.5
13*	127.8	121.8	139.8
14	123.8	129.5	134.5
15	107.7	114.7	122.7
16	116.3	111.8	126.5
17	126.3	121.0	137.0

Note. *Qualified for State Championship (continued)

Table 18

Mean Creativity Scores by Team

Team Number	TTCT-Verbal, Fluency	TTCT-Verbal, Flexibility	TTCT-Verbal, Originality
18*	137.8	133.0	144.3
19*	106.5	111.5	123.5
20*	111.5	118.0	125.5
21	103.3	107.3	118.3
Total	114.7	114.6	127.3

Note. *Qualified for State Championship

The means and standard deviations for each instrument are shown in Table 19 shows the means and standard deviations for each instrument as well as program type.

Table 19

Posttest Mean Scores and Standard Deviations

Source	Mean	SD
QP	109.00	10.55
Program Type	0.47	0.50
TTCT-Verbal, Fluency	115.97	16.31
TTCT-Verbal, Flexibility	115.60	15.90
TTCT-Verbal, Originality	128.37	14.29

Assumptions. The researcher examined the assumptions for a multiple linear regression for normality, linearity, homoscedasticity, and independence. One participant

from the comparison group did not complete the TTCT-Verbal booklet. Therefore, the data set (n = 68) consisted of 32 participants in the treatment group and 36 in the comparison group.

Normality. The researcher first examined normality was of TTCT-Verbal, Fluency, TTCT-Verbal, Flexibility, and TTCT-Originality scores by looking at a Box and Whiskers plot, and then by checking skewness and kurtosis. The results showed all three measures as within the acceptable limits of + or – 2 as defined by D’Agostino, et al. (1990) for normality. See Tables 20-22 for these scores.

Table 20

Normality of TTCT-Verbal, Fluency Scores by Group

Group	Mean	SD	Skewness	Kurtosis
Comparison	119.06	14.378	-.124	-.020
Treatment	111.71	17.364	.312	-.838
Total	115.97	16.309	-.048	-.668

Table 21

Normality of TTCT-Verbal, Flexibility Scores by Group

Group	Mean	SD	Skewness	Kurtosis
Comparison	115.56	16.162	-.021	-.591
Treatment	114.94	15.684	.661	-.230
Total	115.60	15.903	.270	-.515

Table 22

Normality of TTCT-Verbal, Originality Scores by Group

Group	Mean	SD	Skewness	Kurtosis
Comparison	131.25	13.161	-.512	.104
Treatment	124.54	14.557	.093	-1.213
Total	128.37	14.288	-.288	-.828

To further examine normality, the researcher selected a Shapiro-Wilk test. Neither the treatment nor the comparison groups had significant results for any TTCT-Verbal measure. See Table 23 for the results.

Table 23

Shapiro-Wilk Tests for Normality by Measure

Measure	Comparison	Treatment
TTCT-Verbal, Fluency	.859	.293
TTCT-Verbal, Flexibility	.797	.039
TTCT-Verbal, Originality	.311	.071

Linearity. The researcher determined linearity by visual inspection of plots of the observed v. predicted values. The diagonal lines showed symmetry.

Homoscedasticity. After examining scatterplots visually, the researcher deemed homoscedasticity as acceptable for both the treatment and comparison groups for all measures.

Independence. The treatment and the comparison groups represented two intact groups. Since students participated as members of only one group, the researcher determined that the groups as independent, and thus met the assumption of independence.

Multicollinearity. The researcher checked multicollinearity by using The Variance Inflation Factor for all measures (Program Type = 1.000, TTCT-Verbal, Fluency = 1.043, TTCT-Verbal, Flexibility = 1.000, and TTCT-Verbal, Originality = 1.049) and determined them to be acceptable (< 10) as were tolerance values ($> .1$) (Stevens, 2002). Next, the researcher conducted a Pearson r correlation for all measures. There was a significant correlation between QP scores and program type ($p < .001$) with students in the treatment group having higher scores. There was a significant negative correlation between FPSPI Program type and TTCT-Verbal, Fluency ($r = -0.20, p < .05$), with students in the comparison group having a higher score than students in the treatment group. There was no significant relationship between QP scores and TTCT-Verbal, Originality, TTCT-Verbal, Flexibility.

There was also a significant correlation between TTCT-Verbal, Fluency and TTCT-Verbal, Flexibility ($r = 0.77, p < .001$) as well as between TTCT- Verbal, Fluency and TTCT-Verbal, Originality ($r = 0.97, p < .001$). Students with higher TTCT-Verbal, Fluency scores had higher scores on all subtests on those subtests also had higher scores on the TTCT-Verbal, Flexibility and/or TTCT-Verbal, Originality subtests and students with lower scores on the TTCT-Verbal, Fluency had lower scores on the TTCT-Verbal, Flexibility and TTCT-Verbal, Originality subtests. The researcher then made the decision to continue to use the TTCT-Verbal subtests as opposed to the TTCT-Verbal, Total even though there was some multicollinearity to the data more specifically. See Table 24 for these results.

Table 24

Intercorrelations of Creativity Scores on Five Measures

	Measure	M	SD	1	2	3	4	5
1.	Qualifying Problem	109.00	10.56	-				
2.	Program Type	.47	.50	.001*	-			
3.	TTCT-Verbal, Fluency	115.97	16.31	.048*	.049*	-		
4.	TTCT-Verbal, Flexibility	115.60	15.90	.372	.490	.001*	-	
5.	TTCT-Verbal, Originality	128.37	14.29	.067	.039	.001*	.001*	-

Note. Coefficients are significant at $p < .05$

Results for the multiple linear regression procedure. The researcher analyzed the data using a researcher-controlled regression method (Meyers, et al., 2006) selecting a hierarchical analysis with program-type as a covariate in the first block. Using the hierarchical analysis provided the advantage of giving precedent to the predictor of program-type, which the researcher entered first, over the ones entered in the second block (Meyers, et al., 2006). QP scores acted as the criterion variable with program-type entered in the first block and TTCT-Verbal, Fluency, TTCT-Verbal, Flexibility and TTCT-Verbal, Originality scores entered as one unit in the second block as predictor variables. Table 25 shows the results of the regression indicating the results for each block of the regression.

Table 25

Summary of Hierarchical Multiple Regression Analysis with Qualifying Problem as Criterion after Accounting for Program Type

Block	R	R ²	Adjusted R ²	ΔR^2	Sig. F Change
1	.383 ^a	.146	.133	.146	.001
2	-.170 ^b	.181	.129	.035	.454

a. Predictor: FPSPI Program Type

b. Predictors: TTCT-Verbal, Flexibility, TTCT-Verbal, Originality, and TTCT-Verbal, Fluency

The hierarchical linear regression was significant, $F(1, 66) = 11.319, p < .001, \eta^2 = .17$, small. Within the model, program type was a significant predictor ($p < .001$), explaining 38.3% of the variance in QP scores. TTCT-Verbal, Fluency ($p = .313$), TTCT-Verbal, Flexibility ($p = .633$), and TTCT-Verbal, Originality ($p = .518$) were not significant predictors of QP scores as shown in Table 26.

Table 26

Hierarchical Multiple Regression Analysis with Coefficients^a

Block	Predictor Variable	B	SEB	β	t	p
1	Program Type	8.028	2.386	.383	3.364	.001
2	TTCT-Verbal, Fluency	-.344	.338	-.532	-1.018	.313
2	TTCT-Verbal, Flexibility	.062	.130	.094	.480	.633
2	TTCT-Verbal, Originality	.219	.337	-.297	.650	.518

a. Criterion Variable: Qualifying Problem

Only Program Type significantly correlated with the posttest, which was known from the results of the first research question where students trained in VIEW outperformed students who did not receive the training on the QP. TTCT-Verbal, Fluency, TTCT-Verbal, Flexibility, and TTCT-Verbal, Originality did not contribute significantly to student performance on the QP. The hypothesis was affirmed.

Results of Research Question 3

The third question was: What are the students' perceptions of their working relationships as members of a Future Problem Solving Program Global Issues Problem Solving team? Seventy-four participants responded to the questionnaire. One participant was not present for the QP. One participant from Team 8 skipped question 8 on the questionnaire.

The researcher selected a total of four teams for interviews with 2 teams from the comparison and 2 teams from the treatment group and with one team from each grade level. See Table 6 for the PP2 and QP scores of each team selected for an interview.

The researcher interviewed 15 participants from a total of four teams of four. The grade 12 team had only three members present on the day of the team interview. Since interview questions included content related to how students worked on their teams, the researcher reviewed the problem solving styles of team members in the treatment group. VIEW scores for interview participants are presented in Table 27.

Table 27

VIEW Scores for Team Interview Participants from Treatment Group

Participant Number	Grade	OC	MP	WD
1	9	72	35	31
2	9	74	40	40
3	9	102	36	40
4	9	67	27	30
5	11	54	42	51
6	11	103	48	45
7	11	91	29	38
8	11	116	22	45

Coding. For the qualitative analysis, the researcher analyzed statements from the questionnaire and team interviews. Seventy-four participants from 21 teams produced statements from both the questionnaire and the four team interviews. The researcher placed these data placed on a spreadsheet and analyzed a total of 1452 responses. These responses formed 1457 statement segments, five of which were duplicated because they provided multiple concepts requiring separate codes. From there, the researcher created 188 codes, 36 categories and 5 themes.

The researcher utilized a cyclical process of coding using an exploratory method for the first cycle (Saldaña, 2013). This process included assignment of data to codes through the use of exploratory and preliminary codes involving a cyclical process of refinement. The researcher first used holistic codes to grasp the basic themes as opposed to analyzing

the data line by line (Dey, 1993). For the second cycle, the researcher used eclectic coding as a form of open coding (Glaser & Strauss, 1967). The second cycle coding allowed for a synthesis of the first cycle codes into a more unified and organized scheme (Saldaña, 2013). The goal of the second cycle of coding was to link seemingly unrelated data by developing an organization and categorization of concepts (Morse, 1994). As the coding progressed through the first and second cycles, the researcher brought meaning, structure, and order to the data (Anfara, 2008). Also in the second cycle, pattern coding was next used to make meaning and develop a tighter analysis (Miles & Huberman, 1994). The researcher used pattern coding to develop a meta-code that was used to identify similarities in coded data (Saldaña, 2013). The researcher then developed themes from the categories, basing them on patterns in the data that organized a group of repeating ideas (DeSantis & Ugarriza, 2000).

Analysis. The researcher could not code 21 statements (17 treatment, 4 comparison) because they were illegible, unintelligible or left blank. Eleven statements were multiply coded. The 188 codes produced from 1457 statements are listed in Appendix U.

Of the total amount of statements analyzed (720), 720 statements (49%) came from the treatment group members and 737 statements (51%) from those in the comparison group. Of these statements, 985 (68%) came from the questionnaire and 472 (32%) came from the interviews. The number of responses produced for each code from the interviews and questionnaire are presented in Appendix V.

Over twice as many codes came from questionnaire than from the interview. Some codes came from only one instrument, and some responses produced only one code. At this point, the researcher collapsed the codes into categories. The categories that were generated from codes by instrument are shown in Appendix W.

The researcher determined that the questionnaire and interviews produced similar information and therefore could be analyzed together. An analysis of the number of categories produced from the interviews and questionnaire is presented in Table 28.

Table 28

Frequency and Percentage of Responses by Category and Instrument

Category	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Application	6	7	79	93
Background knowledge	9	43	12	57
Cohesiveness	33	62	20	38
Collaboration	80	84	15	16
Collegiality	9	64	5	36
Creativity	97	86	16	14
Decision-making	36	78	10	22
Discussion	37	93	3	7
Experience	7	17	34	83
Focus	61	87	9	13
Generating ideas	45	78	13	22
Group composite	1	7	14	93
Group discord	49	71	20	29
Group diversity	20	36	36	64
Leadership	32	78	9	22

(continued)

Table 28

Frequency and Percentage of Responses by Category and Instrument

Category	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Listen to others	8	67	4	33
Mistakes	20	77	6	23
On-task	10	48	11	52
Organization	17	94	1	6
Participation	0	0	9	100
Practice	10	83	2	17
Problem solving style	2	20	8	80
Quality	11	85	2	15
Relevance	6	100	0	0
Research	53	98	1	2
Schedule	9	90	1	10
Scope	6	60	4	40
Self-knowledge	8	44	10	56
Shared Responsibility	72	82	16	18
Steps	96	78	27	22

(continued)

Table 28

Frequency and Percentage of Responses by Category and Instrument

Category	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Strengths-based	21	50	21	50
Teamwork	8	73	3	27
Time Management	55	71	23	29
Underlying Problem	19	83	4	17
Who Benefits	1	4%	22	96
Writing	31	94	2	6
Total	985	68	472	32

Themes. The researcher derived the following themes from the codes and categories: 1. Theme 1: The students recognized the benefits of the program; 2. Theme 2: The students identified group processes in FPSPI; 3. Theme 3: The students identified management aspects of an FPSPI team; 4. Theme 4: The students recognized the technical aspects of the FPSPI process; Theme 5: The students demonstrated understanding of self and others. The categories used to generate the themes are described in Table 29.

Table 29

Themes Generated from Categories

Theme	Category Number	Categories	Number of Statements Analyzed	Number of Codes
Benefits of the program	1	Application	85	19
	2	Creativity	113	9
	3	Quality	13	5
	4	Who benefits	23	5
Group processes	1	Cohesiveness	53	5
	2	Collaboration	95	9
	3	Collegiality	14	3
	4	Decision-making	46	7
	5	Discussion	40	5
	6	Group composite	15	4
	7	Group discord	69	9
	8	Group diversity	56	11

(continued)

Table 29

Themes Generated from Categories

Theme	Category Number	Categories	Number of Statements Analyzed	Number of Codes
Group processes	9	Leadership	41	7
	10	Listen to others	12	4
	11	Shared responsibility	88	3
	12	Teamwork	11	3
Management	1	Focus	70	5
	2	On-task	21	2
	3	Organization	18	4
	4	Participation	9	3
	5	Practice	12	3
	6	Schedule	10	2
	7	Time Management	78	6
Technical	1	Background knowledge	21	3
	2	Experience	41	9
	3	Generating ideas	58	6
	4	Mistakes	26	5
	5	Relevance	6	2
	6	Research	54	4

(continued)

Table 29

Themes Generated from Categories

Theme	Category Number	Categories	Number of Statements Analyzed	Number of Codes
Technical	7	Scope	10	3
	8	Steps	123	6
	9	Underlying Problem	23	3
	10	Writing	33	5
Understanding of Self and Others	1	Problem solving style	10	2
	2	Self-knowledge	18	5
	3	Strengths-based	42	4

Next, the researcher analyzed the themes by instrument. For the first theme, Benefits of the Program, approximately the same number of statements came from the questionnaire and the interview. The ratio of statements from the questionnaire and interview was approximately 3:1 for the following themes: Group Process, Management, and Technical. For the fifth theme, Understanding of Self and Others, 44% of the statements came from the questionnaire and 56% came from the interview. This information is shown in Table 30.

Table 30

Number of Themes by Instrument

Theme	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Benefits of the program	115	49	119	51
Group processes	385	71	155	29
Management	162	74	56	26
Technical	292	74	103	26
Understanding of Self and Others	31	44	39	56
Total	985	68	472	32

The researcher analyzed the themes derived from statements made by the treatment group and the comparison group. Participants in the treatment group (70%) made more statements than those in the comparison group (30%) related to an understanding of self and others while participants from the comparison group (63%) made more statements than the students in the treatment group (37%) about the technical aspects of FPSPI. The treatment group also made comments about the technical aspects of the FPSPI process, although this group made more comments than the comparison groups directed to Understanding of Self and Others, Group Processes, Benefits of the Program, and Management. Participants in the comparison group also made comments in the other four themes, but less frequently than those in the treatment group. See Table 31 for this information.

Table 31

Themes by Group

Theme	Number of Categories	Number of Codes	Total Number of Statements	Number of Statements from Treatment Group	Percentage of Statements from Treatment Group	Number of Statements from Comparison Group	Percentage of Statements from Comparison Group
Benefits of the program	4	38	234	126	54	108	46
Group processes	12	70	540	286	53	254	47
Management	7	25	218	111	51	107	49
Technical	10	46	395	148	37	247	63
Understanding of Self and Others	3	11	70	49	70	21	30

Figure 2 displays the five themes generated from the 36 categories: Benefits of the Program, Group Processes, Management, Technical and Understanding of Self and Others.

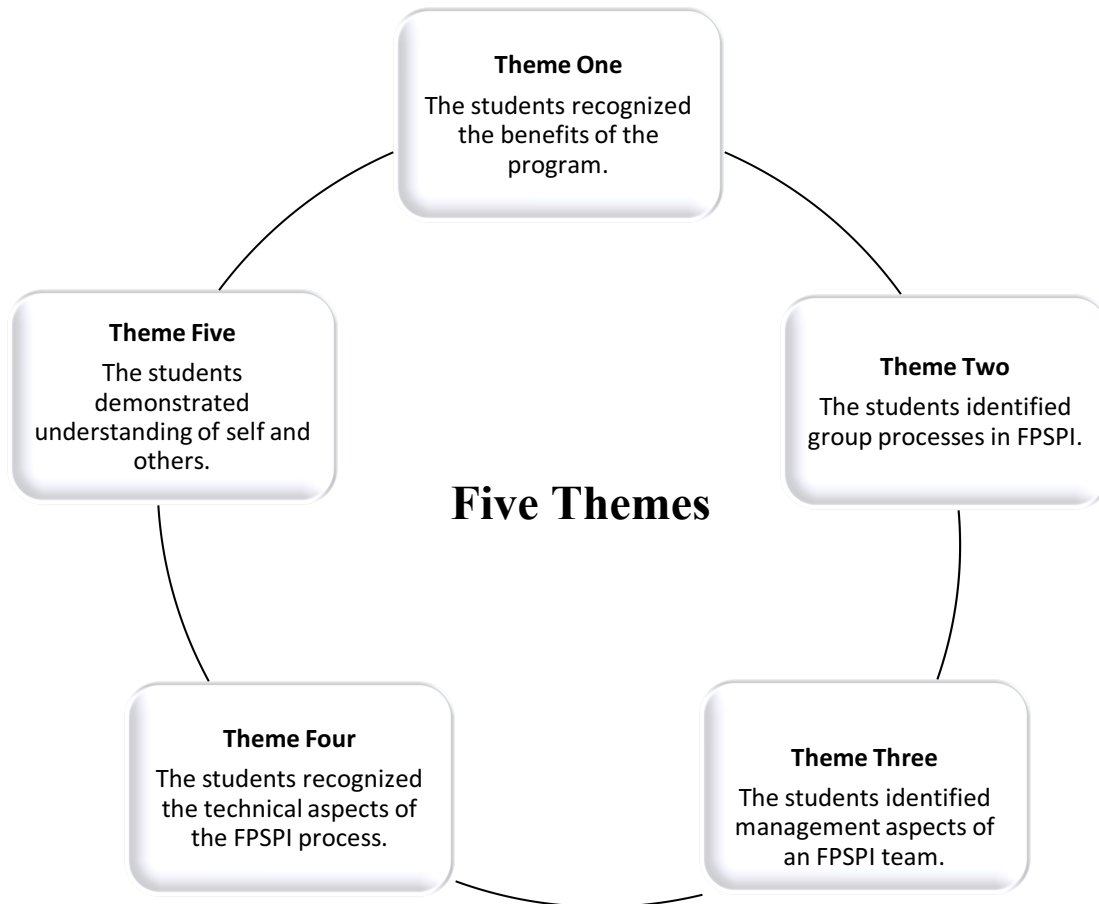


Figure 2. Five themes.

Theme 1: Benefits of the program. The first theme, Benefits of the Program, came from four categories: Application, Creativity, Quality and Who benefits. Students from both the treatment and comparison groups recognized the benefits of the FPSPI program. A participant (63) from the comparison group, in a statement that was categorized as Application, said: “[FPSPI] has allowed me to understand my personal thinking and problem solving process. This

allows me to maximize my potential in other subject areas.” Table 32 shows the team, grade level and VIEW scores, if applicable, for the participants.

Table 32

Participant Data

Participant Number	Grade Level	Team Number	Years of FPSPI Experience	Group
1	11	9	3	Treatment
2	11	10	2	Treatment
3	11	9	5	Treatment
4	11	8	6	Treatment
5	11	8	4	Treatment
6	11	10	5	Treatment
7	11	8	6	Treatment
8	11	10	6	Treatment
9	11	11	3	Treatment
10	11	7	6	Treatment
11	11	9	3	Treatment
12	11	9	5	Treatment
13	11	11	3	Treatment
14	11	8	6	Treatment

(continued)

Table 32

Participant Data

Participant Number	Grade Level	Team Number	Years of FPSPI Experience	Group
15	11	7	6	Treatment
16	11	11	2	Treatment
17	11	7	3	Treatment
18	11	10	6	Treatment
19	11	7	3	Treatment
20	11	11	2	Treatment
21	10	14	2	Comparison
22	10	13	2	Comparison
23	10	16	1	Comparison
24	10	13	2	Comparison
25	10	13	7	Comparison
26	10	15	6	Comparison
27	10	15	1	Comparison
28	10	13	1	Comparison
29	10	17	1	Comparison
30	10	16	1	Comparison
31	10	12	6	Comparison
32	10	16	1	Comparison

(continued)

Table 32

Participant Data

Participant Number	Grade Level	Team Number	Years of FPSPI Experience	Group
33	10	14	2	Comparison
34	10	17	2	Comparison
35	10	15	2	Comparison
36	10	14	6	Comparison
37	10	17	2	Comparison
38	10	16	1	Comparison
39	10	12	2	Comparison
40	10	14	2	Comparison
41	9	21	1	Treatment
42	9	20	1	Treatment
43	9	18	6	Treatment
44	9	19	2	Treatment
45	9	20	1	Treatment
46	9	21	1	Treatment
47	9	19	1	Treatment
48	9	18	1	Treatment
49	9	18	5	Treatment
50	9	20	1	Treatment
51	9	19	6	Treatment

(continued)

Table 32

Participant Data

Participant Number	Grade Level	Team Number	Years of FPSPI Experience	Group
52	9	21	2	Treatment
53	9	20	1	Treatment
54	9	18	1	Treatment
55	9	19	4	Treatment
56	12	6	3	Comparison
57	12	6	3	Comparison
58	12	3	4	Comparison
59	12	2	6	Comparison
60	12	1	4	Comparison
61	12	5	3	Comparison
62	12	1	9	Comparison
63	12	4	4	Comparison
64	12	3	3	Comparison
65	12	2	4	Comparison
66	12	4	4	Comparison
67	12	6	4	Comparison
68	12	4	4	Comparison
69	12	5	8	Comparison

(continued)

Table 32

Participant Data

Participant Number	Grade Level	Team Number	Years of FPSPI Experience	Group
70	12	2	8	Comparison
71	12	1	7	Comparison
72	12	2	6	Comparison
73	12	3	3	Comparison
74	12	5	4	Comparison
75	12	4	2	Comparison

Participants also recognized the benefits to the development of creativity, particularly using brainstorming as a tool, with one in the treatment group (20) commenting, “The strengths of my team were being able to brainstorm many relevant problems and solutions.” Both groups recognized a high standard of quality, with one participant from the comparison group (69) commenting, “If one of the members said something below the intellectual standard upheld in our group they are usually persecuted.” As far as who benefits from the program, one participant from the comparison group (72) referenced the benefits of the class saying, “I do think that it’s a different kind of class and I think that that’s really awesome that this type of thing is available to students because I’m a big supporter of like things that aren’t like standardized testing, textbook classes.” As far as the type of student who would benefit from such a program, one participant from the treatment group (45) said, “I think almost any student could benefit from it because it’s problem solving, everybody has to solve problems.” Comments were balanced between the treatment and comparison groups and were similar in content and frequency.

Theme 2: Group processes. The second theme, Group Processes, came from 12 categories: Cohesiveness, Collaboration, Collegiality, Decision-making, Discussion, Group composite, Group discord, Group diversity, Leadership, Listen to Others, Shared Responsibility, and Teamwork. Students from both the treatment and comparison groups identified group processes in FPSPI.

Referring to VIEW training, a participant from the treatment group (2) joked, "I'm different from them thinking-wise. They don't like the way I think." Another participant in the treatment group (45) acknowledged that strengths come with diversity saying, "We clash a little bit but it's for the better." Another treatment group participant (53) said, "It's really not about...if you got...the smartest people on your team. It's really just if you guys can cooperate and get something done." In the group composite category, one participant in the treatment group (13) said, "The people who I am around are imperative in determining how I'll think during a booklet."

While these statements from the treatment group reflected the training they had received in VIEW, other statements about group processes were balanced between the treatment and comparison group. In the cohesiveness category, one participant from the comparison group (28) stated, "The strengths of our team were how we pulled each other's weight." Referring to collaboration, another participant from the comparison group (75) said, "Our biggest strength when completing this booklet was our communication of ideas." Yet another comparison group participant (58) stated, "There were no major conflicts, but differences of opinion were done by discussion," and another (30) said, "If we disagreed on an idea, we talked about each person's opinion," which both were categorized as Collegiality.

In the Decision-making category, one participant from the treatment group (42) stated, “I learned that I am good at picking out challenges from the story and looking through the data to find what's important.” A participant from the comparison group (26) commented, “Conflicts were handled by discussing the issue with group members and democratically deciding which choice was the best.”

One treatment group participant (49) described discussion among group members saying, “We discuss the issues and share our thoughts and that usually resolves the issues.” Referring to group discord, one participant from the comparison group (22) said, “The weaknesses of my team include our ability to communicate with each other,” while another from the treatment group (45) suggested, “Be more open to other ideas.”

In the category of Group Diversity, a participant in the comparison group (37) said, “I believe the main strength of our team was the fact that we are all different thinkers. We were able to easily bounce ideas off of each other.” A participant from the treatment group (2) talked about “dealing with people that think differently than me.”

In the Leadership category, one participant from the comparison group (31) said, “It is usually up to me to make sure that the booklet is headed in the right direction, along with the rest of the team, something which I think I do well.” Another (35) said, “My strength was that I was a leader. I assigned work when I felt it was needed and assisted my teammates too.”

On the topic of listening to others, one participant from the comparison group (24) remarked, “Some of the challenges I face as a group member are accepting members' ideas and becoming a perfectionist. This can take up valuable time when editing/revising is done.” Another from the treatment group (52) said, “I learned that I try to listen to everyone's ideas with an open mind which may improve communication among members.”

In the Shared Responsibility category, one participant from the comparison group (64) remarked, “My team and I make sure that we divide up the steps in terms of who is better at which steps.” Another from the treatment group (15) said, “We have a pretty decided order for how the steps of our booklet are executed and who does what. Some steps are done by all, and some steps only require 1 or 2 people to do them.” On the topic of teamwork, one participant from the comparison group (72) said, “We all ALWAYS put in an equal amount of effort on our booklets. I don't think any of us ever felt excluded during the booklet.”

Some statements from the treatment group reflected training in VIEW. With that exception, most statements made in this theme were balanced between the treatment and comparison groups and were similar in content.

Theme 3: Management. The researcher generated the third theme from seven categories: Focus, On-task, Organization, Participation, Practice, Schedule and Time Management. Statements made by participants identified management aspects of an FPSPI team. Comments, such as this one from a participant in the comparison group (65), revolved around work completion and time management: “I think the last booklet that we had to do like seven more combined Step Ones and Threes to finish...and we had like ten minutes.”

In the Focus category, one participant from the comparison group (22) said, “One or two of my team members becoming not focused and our whole booklet does not reach its fullest potential.” In the On-task category, another participant, also from the comparison group (34), said, “I have learned that if I stay on track, I can actually get a lot of work done.”

In the Organization category, one participant from the comparison group (63) remarked, “Our team should meet prior to future booklets in order to plan our booklet completion schedule,” while another from the treatment group (18) said, “I coordinated who was doing

what.” Participation remarks revolved around the setup of FPSPI this particular high school, which allowed students to take the FPSPI course instead of history.

Participants emphasized the importance of practice. One talked about the importance of going over the research and process, while another from the comparison group (22) said that practice “would make us more prepared when we sit down to do our booklet.” This also came up in terms of scheduling time to meet and discuss topics outside of class.

Participants from both groups talked about time management. One participant from the comparison group (31) shared the team had perfected this skill saying, “We were able to go in and work quickly and efficiently.” Others felt time management was a weakness. One participant from the treatment group (42) stated, “We have poor time management and sometimes feel pressed to finish,” and another (20) said, “[A challenge] I faced [was] having to complete the booklet at a quicker pace than I would have liked.” Statements made by both participants in the comparison and treatment groups around the theme of management were balanced between groups and were similar in content.

Theme 4: Technical. The researcher generated the fourth theme, Technical, from 10 categories: Background knowledge, Experience, Generating ideas, Mistakes, Relevance, Research, Scope, Steps, Underlying Problem, and Writing. Participants in the comparison group made more comments about technical aspects of the FPSPI process than the treatment group did. One participant in the comparison group (61) commented, “I have learned that I tend to overlook many issues in the Future Scene due to a quick scan rather than a careful reading.”

In the category, Background Knowledge, one participant from the comparison group (38) described how lack of knowledge about a subject “sometimes resulted in a shortage of well-written step 1's or step 3's.” In the experience category, one participant from the comparison

group (30) remarked, “A weakness of my team would be that we are all new (from middle school to high school) to [FPSPI] this year. This is a weakness because we all didn't know the steps as well and it took us a little longer to figure stuff out.” Another from the comparison group (72) said, “I think it’s just kind of like the longer that you do it the more comfortable you get and the better you are at it.” Yet another from the treatment group (18) said, “I’d just say that it gets easier....It’ll click eventually but it’s definitely hard at first. At first it’s like overwhelming.”

Under the category of Generating Ideas, as one the technical aspects of FPSPI, participants referenced brainstorming as an important technique. One participant from the comparison group (75) said, “One challenge I faced in the booklet was using creativity to generate ideas to use. I have always had trouble with being creative and it became a difficulty in the booklet.”

Participants from both groups worried about mistakes. One participant from the comparison group (23) said, “We worry about utilizing as many categories as possible while making sure there are no duplicates.” Another from the treatment group (12) said the group thinks “reading over each [other’s] problems/solutions after we wrote them in the booklet may have helped us to not lose as many points.”

Participants defined Relevance as an important skill. One participant from the treatment group (7) said, “We need to improve on our connections to the problem...and/or solution purposes when applicable.”

One participant from the comparison group (38), identifying Research as a helpful tool said, “One thing that would really help would be if we all studied and researched the topic more than we had.” Another from the treatment group (3) stated, “I learned that by doing extra studying of the topic, I am able to generate more ideas pertaining to the topic.”

Participants suggested making sure the appropriateness of the scope neither too broad nor too specific. One participant from the comparison group (38) said, “We found that it’s a lot easier to make it like more general so that you can base a lot of different solutions off of it.”

Many participants referred to the steps as an integral technical aspect of the FPSPI process. One participant from the comparison group (32) said, “To help my team function better I think certain members needed to review notes on how to write certain steps correctly.”

Another participant from the treatment group (41) said, “The strengths of my team was writing step ones. The strengths of my team was also developing step 3's. We felt the most comfortable writing these.” A participant from the comparison group (38) specified step 2, the Underlying Problem, as an important technique to master: “The strengths of my team were that we always were able to identify an underlying problem.”

Participants identified Writing as an important technique. One participant from the comparison group (40) said, “Our strengths included our ability to communicate our ideas,” while another (32) said, “The weakness of my team was our overall writing; how to explain our thoughts in depth and incorporate necessary parameters for each step.”

Statements made by both participants in the comparison and treatment groups around the theme of the technical aspects of FPSPI were balanced between groups in terms of similarity of content. The frequency of statements made by the comparison group (63%) far exceeded the frequency of statements made by the treatment group (37%).

Theme 5: Understanding of self and others. The fifth theme, Understanding of Self and Others, came from three categories: Problem-solving style, Self-knowledge, and Strengths-based. In the category of Problem-solving style, one student from the treatment group (50) commented, “We managed to learn...who's better at what and who's more quiet and who thinks

things out.” One participant, from the treatment group (45), referring to the dimensions of problem solving style from VIEW training, stated, “If they're like that then we should go to them for that.” A participant from the comparison group (36) said, “I have learned about the way I think compared to my teammates.”

In the Self-knowledge category, a participant from the comparison (32) said, “I think I’m a pretty organized person...and I think that I’m usually kind of, ‘Ok we only have this much time’ which I guess might be kind of stressful for some people but for me it’s just how I keep things organized, so it’s kind of taught me that about myself.” A participant from the treatment group (18), who has a strong Developer and Task preferences, said “Um what have I learned about myself?...Mostly how usually with group work I kind of like take control like get what I have to get done.”

In the Strengths-based category, a participant in the comparison group (56) said, “We understand [each other’s] strengths and weaknesses, so we try to work through these. We don’t give anyone a task we don’t believe they will be good at.” A participant in the treatment group (17) said, “Everyone has the steps that they excel at so we usually stick to those steps.” This participant, who has a strong Developer preference also said, “I am nit-picky about the way things are done.” Another participant in the treatment group (45) said, “We understand each other better and like we can try to bring the best out of everybody in the group.”

While there was some similarity in the statements made by both participants in the comparison and treatment groups around the theme of the understanding self and others, there were statements made by participants in the treatment group which reflected VIEW training. In addition, the frequency of statements made by the treatment group (70%) far exceeded the frequency of statements made by the comparison group (30%).

Triangulation

The researcher analyzed three constructs in relation to FPSPI performance: creative problem solving, problem solving style, and creativity. Figure 3 shows how all three constructs combine to form the foundation for analysis of FPSPI performance.

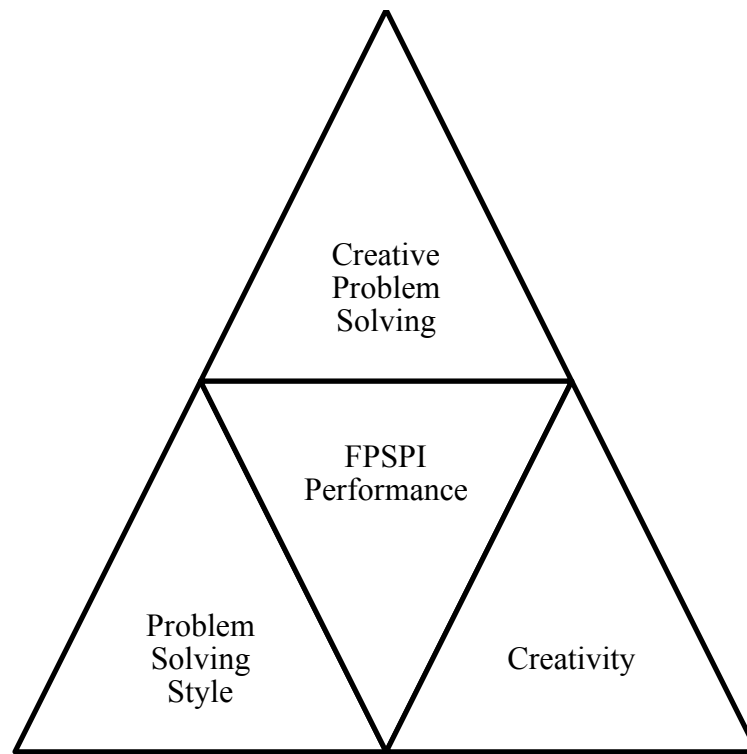


Figure 3. Triangulation of Data.

The instruments used to measure CPS and FPSPI performance were the PP2 and the QP. Research Question 1 and the theme of Understanding Self and Others addressed the construct of problem solving style, as assessed by VIEW. The results of Research Question 1 showed there was a significant difference ($F(1,66) = 7.44, p < .008$) between the mean QP scores for the treatment group ($M = 112.135$, adjusted) and the comparison group ($M = 106.100$, adjusted) after controlling for PP2 scores, eta squared = .10, small.

The instruments used to measure problem solving style as related to FPSPI performance were VIEW, the questionnaire, the semi-structured interviews, and the QP. Understanding problem solving style, as shown by the quantitative results of Research Question 1, allowed participants who received training in problem solving style to score significantly higher on the QP, as a measure of FPSPI performance than students who did not receive this training. In addition, students trained in problem solving style made statements about Understanding Self and Others more frequently than students who did not receive this training.

The instruments used to measure creativity in relation to FPSPI performance were TTCT-Verbal, Form A, the questionnaire, the semi-structured interviews, and the QP. The results of Research Question 2 demonstrated the hierarchical linear regression was significant, $F(1, 66) = 11.319, p < .001, \eta^2 = .17$, small. Within the model, program type was a significant predictor ($p < .001$), explaining 38.3% of the variance in QP scores. TTCT-Verbal, Fluency ($p = .313$), TTCT-Verbal, Flexibility ($p = .633$), and TTCT-Verbal, Originality ($p = .518$) were not significant predictors of QP scores. Creativity was similar in both groups and was not a factor in the differences in the FPSPI performance of the two groups. Statements from the participants from each of the groups were similar in frequency in the category of Creativity and in the theme of Benefits of the Program.

Both the quantitative and qualitative results support how the constructs of creative problem solving, problem solving style, and creativity contribute to achievement in FPSPI performance. Student responses on the questionnaire and the results of the semi-structured team interviews support how the constructs contribute to FPSPI performance.

CHAPTER FIVE:

SUMMARY AND RECOMMENDATIONS

Treffinger (2011) argued that education must be responsive to the challenge of preparing students to deal with creativity, innovation and change, and that efforts are needed to provide students the opportunity to learn 21st century skills. Effective ways to teach creativity, particularly for adolescents (Woodel-Johnson, 2010) as well as to enhance team performance need substantiation. This study investigated how understanding and applying problem-solving styles, in a setting designed to enhance creative problem-solving, effects performance and process.

Though researchers have conducted studies in creativity for more than six decades, there has been a renewed attention to the study of creativity (e.g., Bronson & Merryman, 2010). The researcher reviewed recent studies of creativity, the Future Problem Solving Program International (FPSPI) and its relationship to Creative Problem Solving (CPS), and problem-solving styles. These constructs formed the theoretical and research foundation for the current study. A lack of research about the role of problem solving style as it relates to creative problem solving in adolescents lead to the need for the current study.

Research Questions

The research was conducted using a mixed method model involving quasi-experimental and correlational analyses as well as student responses from a questionnaire and team interviews. Participants were grade 9-12 students ($n = 75$) from one suburban high school who participated in the Global Issues Problem Solving (GIPS) component of the Future Problem Solving Program (FPSPI).

Research Question 1

Is there a significant difference in Future Problem Solving Program Global Issues Problem Solving scores between students who were trained in understanding and applying their problem-solving styles and students who did not receive training about their problem-solving styles?

Non-directional hypothesis: There will be a significant difference in Future Problem Solving Program Global Issues Problem Solving scores between students who were trained in understanding and applying their problem-solving styles and students who did not receive training about their problem-solving styles.

Research Question 2

To what extent and in what manner will variation in Future Problem Solving Program Global Issues Problem Solving scores be predicted by fluency, flexibility, and originality scores on the *Torrance Test of Creative Thinking-Verbal*, after accounting for participation in Future Problem Solving Program group membership?

Directional hypothesis: Fluency, flexibility, and originality scores on the *Torrance Test of Creative Thinking-Verbal* will not significantly predict Future Problem Solving Program Global Issues Problem Solving scores after accounting for differences in Future Problem Solving Program group membership.

Research Question 3

What are the students' perceptions of their working relationships as members of a Future Problem Solving Program Global Issues Problem Solving team?

Review and Explanation of Findings

The results of the current study are reviewed and interpreted. An explanation of the findings of the current study is described below in detail.

Research Question 1

For the first research question, an ANCOVA was used to compare the difference between the mean scores of the Qualifying Problem (QP) (dependent variable) for high school students in two different programs: those who participated in problem solving styles training along with FPSP-GIPS (treatment) and those engaged in the FPSP-GIPS only (comparison), after controlling for initial differences in an FPSPI problem solving scenario. The covariate was the pretest, (PP2) that was used when scores from the treatment group were found to be significantly higher than those for members of the comparison group.

The results of Research Question 1 showed there was a significant difference ($F(1,66) = 7.44, p < .008$) between the mean QP scores for the treatment group ($M = 112.135$, adjusted, $SD = 3.20$) and the comparison group ($M = 106.100$, adjusted, $SD = 2.96$) after controlling for PP2 scores, eta squared = .10, small. The null hypothesis was rejected favoring students who received training in problem solving styles.

In addition 47% of the students in the comparison group (17% of the sophomores and 67% of the seniors) and 89% of the student in the treatment group (75% of the freshmen and 100% of the juniors) had QP scores that qualified for the state competition. Two teams from the treatment group qualified for the international competition, while no teams from the comparison group qualified. One of those teams from the treatment group received sixth place at the international competition.

The results of the present study are not consistent with the previous study conducted by Treffinger in 2006, who explored the effect problem solving style training had on FPSPI performance with middle and senior level teams from FPSPI. The reason for this result stems most likely from the fact that the teams in Treffinger's study did not necessarily remain intact throughout the project that may have impacted the results. It was, therefore, a requirement in the current study that groups remain intact for the duration of the project. In addition, the current study involved VIEW training with exercises for students, ongoing training from the coach, and support for the coach. This extended beyond the scope of the training provided in the Treffinger (2006) study and likely contributed to the positive outcomes for the present study. It is recommended that future investigations consist of intact groups as well as training exercises in VIEW for participants.

In another study taking place in 2006, Prichard, Bizo and Stratford, suggested the benefits of team skills training to enhance performance. Two years later Treffinger, Selby and Isaksen (2008) examined the construct of problem solving style in relation to CPS. In that study, when individuals had an understanding of their own problem solving style, they were then able to learn and apply CPS tools more effectively. When team members understood the styles of individuals on the team, problem solving was improved.

Research Question 2

For the second research question, a hierarchical multiple linear regression was used to determine to what extent and in what manner creative thinking predicted performance in a creative problem-solving scenario after accounting for participation in FPSPI where students were trained in problem solving style as compared to those who were not. Within the regression model, program type was a significant predictor ($p = .001$), explaining 38.3% of the variance in

QP scores, while creativity of participants as measured by TTCT-Verbal, Fluency ($p = .313$), TTCT-Verbal, Flexibility ($p = .633$), and TTCT-Verbal, Originality ($p = .518$) were not significant predictors of QP scores. The hypothesis was accepted with FPSPI scores being significantly predicted by participating in problem-solving styles training yet not predicted by fluency, flexibility, and originality scores on the TTCT-Verbal.

This means that the difference in scores due to training in problem-solving styles was not due to differences in level of creativity between the groups. This result is supported by Treffinger, et al. (2013) who assert that the more aware an individual is of his or her problem solving style, the more effective that individual can be at solving problems either individually or in a group.

Research Question 3

For the third research question, qualitative data were coded based on themes to determine perceptions of the creative problem-solving process of students who learned about their problem solving styles and those who did not. Participants in the treatment group made more statements than those in the comparison group related to an understanding of self and others while participants from the comparison group made more statements than the treatment group about the technical aspects of FPSPI. According to Moskowitz (2005), understanding others is the most frequent and most important act in which humans engage.

Czerwiec (1992) analyzed the perceptions of coaches and students about the FPSPI program. Factors that were considered strengths of FPSPI as determined by the students were: teamwork (22.5%), competitive bowls (18.9%), knowledge gained (17.2%), learning about the future (17.2%), creativity (17%), thinking skills (14.5%), making a difference in the world (13.9%), and communication skills (13.2%). The results of the current study support these

findings. The results of the current study support these findings as seen by the equivalent number of responses to themes 1-4 for students in both the treatment and comparison groups for the present study.

Kurtzberg and Reale (1999) determined that teaching FPSPI as part of a middle school curriculum contributed to increasing creative output. In that study, there was a significant difference between the treatment and comparison groups in terms of the number of problems and the number of relevant problems ($p < .01$) completed and between the number of different categories of responses and the total score ($p < .001$) on the posttest. These results supported the findings of the current study because it may be that all students benefit from FPSPI in terms of their creative thinking skills.

Implications of the Study for Education

The results of the current study support The Partnership for 21st Century Skills (2009) identified creativity and innovation, critical thinking and problem solving, and communication and collaboration as important skills for students to acquire. Students trained using VIEW, not only outperformed students who did not receive such training, as found in Research Question 1, but they also identified Understanding of Self and Others with a greater frequency than those who were not trained, as found in Research Question 3.

Treffinger, Selby and Isaksen (2008) argued that problem-solving style can act as a guide for the delivery of instruction. Teachers can differentiate instruction based on problem solving style (Treffinger, et al., 2013).

The results of Research Question 1 have curricular implications for FPSPI and perhaps for other creative problem solving programs. For Research Question 2, there are implications as to the importance of the study of problem solving style for students as suggested by (Treffinger,

et al., 2013). The results of Research Question 3 underscore the recommendations of (Partnership for 21st Century Skills (2009) about important skills students need to acquire: creativity and innovation, critical thinking and problem solving, and communication and collaboration. Table 33 details the implications of the results of the current study for educators.

Table 33

Major Findings and Implications for Educators

Result	Implications for Educators
<p>1. Students trained in problem solving style scored significantly higher on the posttest than students who did not receive this training. In addition 47% of the students in the comparison group and 89% of the student in the treatment group qualified for the state competition. Two teams from the treatment group qualified for the international competition and one of those teams received sixth place at the international competition.</p>	<p>FPSPi might want to include VIEW and training of students by a Qualified User in FPSPi curriculum materials. Other creative problem solving programs might consider adding VIEW and the training of students by a Qualified User to their curriculum as well.</p>

(continued)

Table 33

Major Findings and Implications for Educators

Result	Implications for Educators
2. FPSPI scores were significantly predicted by participating in problem-solving styles training yet not predicted by fluency, flexibility, and originality scores on the TTCT-Verbal.	Educators need to realize the importance of direct instruction about problem solving style for group work as a way to increase creative problem solving performance.
3. Students who participated in FPSPI acquired important skills in creativity and innovation (Theme 1), critical thinking and problem solving (Theme 1), and communication and collaboration (Themes 2 and 5).	Curriculum coordinators and administrators who are looking to increase programs which improve student performance in creative problem solving might consider adding FPSPI programs with the added component of training in problem solving style.

Suggestions for Future Research

The purpose of this study was to measure the effect of training in problem solving style on student Future Problem Solving Performance. This study investigated this topic with three separate research questions. The current study found that problem solving style training had a positive effect on Future Problem Solving performance. The results of each research question are presented to suggest areas for future research.

Research Question One

The results of Research Question 1 suggest future research on the effect of problem solving style training on other areas of performance (e.g., academic achievement) would help to understand the breadth of areas this type of training can support. While problem solving style training predicted Future Problem Solving performance, this study was limited to students who were identified as gifted.

Research Question Two

The results of Research Question 2 suggest future studies on the effects of problem solving style training and the performance of students of various creativity levels would benefit the current body of research. While creative ability was found to not predict Future Problem Solving Performance, the study was limited to students had above average creativity levels.

Research Question Three

Given that students who participated in the treatment spoke of Understanding of Self and Others, while those not trained in VIEW focused more on the technical aspects of the Future Problem Solving Program, further exploration of the effects of social cognition on academic and creative problem solving achievement would add to the research literature. The results of Research Question 3 also suggest further investigation of the benefits of using VIEW with students who are participating in 21st Century learning activities, such as problem based learning. In addition, research into the application of VIEW training in other contexts beyond a Future Problem Solving team or a longitudinal study about the application of participating in such training as part of a Future Problem Solving team would also add to the current literature.

Limitations of the Study

For the quantitative research questions, both internal and external threats were identified. For the qualitative research question, trustworthiness was established. The limitations of the study include a short treatment period. Having a Coach's Log which included a section with links to VIEW for the treatment group would have been helpful as well since the Coach's Log was limited to FPSPI lesson plans for both groups.

Internal Validity

In a quasi-experimental study with a treatment and a comparison group, a mortality threat is thought to be low (Gall, Gall & Borg, 2007). Since other studies of this type have had problems of groups remaining intact due to the length of time of the treatment period and the tendency of Future Problem Solving team membership to change during the period prior to the qualifying problem (Treffinger, 2006), this research was conducted using several contingencies. First, in order to maintain participation groups were selected that were part of a high school course, as opposed to voluntary after school groups where students were not receiving credit towards their work, as these groups were less likely to complete the entire program. Second, commitment from the coach and the teams to stay intact for the duration of the study was also a criterion in the selection of teams.

This study took place in a single high school and the same coach worked with both the treatment and comparison groups; therefore, a high threat to this study was compensatory equalization (Gall, et al., 2007), meaning that there was a chance that the coach would provide similar or comparable instruction to the comparison group to compensate for their lack of participation in the study. The researcher accounted for this in two ways: the comparison group was provided with research materials related to the scenario problem so that the students felt that

they were an important part of the study, and the coach was asked to complete a Coach's Log, as shown in Appendix J, to keep track of activities each of the groups were exposed to during the course of the study. In addition, the coach was notified at the beginning of the study that students in the comparison group would have the opportunity to complete VIEW and receive training in problem solving styles after the FPSPI state bowl. Students who elected to participate in this training were provided with this information by the researcher after the completion of the research study.

External Validity

Population validity (Gall, et al., 2007) was a medium threat to the extent that one could apply the results to another setting. The participants in the study took part in the FPSPI program as part of a course and received credit towards graduation for their efforts in the program. In addition, the coach was well-trained, both in FPSPI and as a teacher. The participants had an average of 3.3 years of experience with FPSPI, and they had high average creativity score with a mean total score of 119. The researcher accounted for this by gathering information about demographics of the participants and the district. In addition, information about the format of the FPSPI program in this school at the beginning of the study was detailed in order for future researchers to determine the applicability of the methods and results.

A threat to ecological validity (Gall, et al., 2007) means that there is the potential that the study would not be able to be repeated because of the complexity of the treatment. The particulars of the experimental treatment were recorded in detail, so the project could be replicated. There was a medium threat of an experimenter effect (Gall, et al., 2007) because the researcher conducted all of the training. This was a threat because there was the potential that the effects of the training would not be able to be repeated. The researcher accommodated for

this issue by recording the particulars of the experimental treatment in detail and by working with other Qualified Users to insure the training would be transferable if individuals who are certified VIEW users who may attempt to replicate the study.

Trustworthiness

Trustworthiness includes the constructs of credibility, transferability, dependability, and confirmability (Toma, 2006). Trustworthiness was addressed by the researcher.

Confirmability means the study can be corroborated by another researcher. This process was addressed through the creation of a clear audit trail (Toma, 2006). The audit trail included both a data-oriented approach (Shenton, 2004) that showed how the data eventually led to recommendations and provided an explanation as to how the data were processed. In addition, an audit was conducted by an independent researcher. A report of the audit is included in Appendix G.

Credibility refers to the believability of the results from the perspective of the participants. The researcher dealt with this by adopting well-established research methods, frequently debriefing with the primary advisor to draw attention to flaws in the proposed course of action, providing background and qualifications of the researcher to both the reader and participants, and using member checking (Shenton, 2004). Participants were asked to read the team interview transcript to ensure accuracy and consideration that their words matched their intent.

Transferability includes the degree to which the results can be generalized to another context. This concept was handled by acquiring detailed demographic information. This also included detailing information about the data collection: the number of participants, the data

collection methods, the length of time of the data collection sessions, and the time period of the data collection (Shenton, 2004).

Dependability means that there is an assumption that the study can be repeated. This was obtained by using a research journal and taking careful notes during the implementation of the treatment. The researcher kept training notes, and the coach kept instructional notes using a Coach's Log. (See Appendix J). Using a process journal and utilizing careful data gathering techniques, the researcher documented the implementation of the research design (Shenton, 2004).

Benefits and Conclusions

This study investigated how understanding and applying problem-solving styles in a creative problem-solving scenario effects performance and process. The results showed that students who work on a problem solving team and are trained in problem solving style perform better and are more reflective about themselves than students who do not receive such training.

There was a significant difference in mean scores of the Qualifying Problem (QP) between the treatment and comparison groups after controlling for pretest scores with students participating in VIEW training outperforming students who did not have this training ($p = .008$). Within the regression model, program type was a significant predictor ($p = .001$), explaining 38.3% of the variance in QP scores, while creativity of participants on the posttest, TTCT-Verbal, Fluency ($p = .313$), TTCT-Verbal, Flexibility ($p = .633$), and TTCT-Verbal, Originality ($p = .518$), were not significant predictors of QP scores because there were no significant differences between groups across the subscales of creativity. The researcher coded the qualitative data based on themes to determine perceptions of the creative problem-solving process of students who learned about their problem-solving styles and those who did not.

Participants in the treatment group made more statements than the comparison group related to an Understanding of Self and Others while participants from the comparison group made more statements than the treatment group about the technical aspects of the steps involved in the completion of the FPSPI process. Eight out of nine of the teams (89%) in the treatment group qualified for the state competition, while four out of twelve (33%) of the comparison groups qualified. Three teams and one individual in the treatment group received awards at the state competition. At the international competition, one team in the treatment group placed sixth in the Team GIPS Senior Division competition.

The study found that instruction in problem solving style using VIEW increased the creative problem solving performance of gifted high school students in FPSPI. More research is needed to determine if this type of training has an effect on performance in other areas or with other groups of students. Since the participants were students identified as gifted, more research on the effects of problem solving style training on the performance of students of various creativity and academic levels is needed.

Training in VIEW resulted in students reporting an Understanding of Self and Others at a greater frequency than students untrained, with those students reporting technical aspects of FPSPI programs. This could have curricular implications for Future Problem Solving Program International and perhaps other creative problem solving programs.

Benefits of the study include an understanding of the benefits of training in problem-solving styles in relation to performance in a creative problem-solving scenario, specifically FPSPI. Another benefit is gaining an understanding of the perceptions of teams involved in training about their problem-solving styles as compared to students who did not receive this type of training. The study has curricular implications for FPSPI and similar creative problem solving

programs. Students who are trained using VIEW, not only outperformed students who did not receive such training, but they also identified Understanding of Self and Others with a greater frequency than those who were not trained.

Limitations to this study include population validity, compensatory equalization, and ecological validity. Suggestions for further research include studying the benefits of VIEW training on performance on the following: students involved with FPSPI for students of all ability levels, other areas of performance (e.g., academic achievement or problem based learning), and the application of those trained in VIEW on other teams or collaborative groups.

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Appendix A: Global Issues Problem Solving Rubric

FPSPI Global Issues Problem Solving Team

Problem: _____ Evaluator #: _____ Division: _____ Booklet #: _____

Step 1 Scoring Guidelines										
Fluency - A Yes challenge is a logical cause or effect of the situations in the future scene. Score	Fluency is determined by totaling the number of Yes challenges and using the following scale: Number of Yes challenges: 1 2 3 4 5-6 7-8 9-10 11-12 13-14 15-16 Number of points awarded = 1 2 3 4 5 6 7 8 9 10									
Flexibility - Measures the number of different categories in Yes challenges. Score	Flexibility is determined by totaling the number of different categories identified. Number of distinct categories: 1 2 3 4 5 6 7 8 9 10 Number of points awarded = 1 2 3 4 5 6 7 8 9 10									
Clarity - Tells what the concern is, why it is a concern, and relates it to the future scene. Score	Hard to determine what challenge is; cause-effect reasoning may be absent or incorrect 1 2 3	Most convey basic idea; lacks detail; cause-effect reasoning is vague or takes leaps 4 5 6	Clear explanations; some detail; most cause-effect relationships make sense 7 8	Well written; clear descriptions with detail; logical cause-effect relationships 9 10						
Originality - Three bonus points may be awarded to any Yes challenge that shows unique creativity or insight into the future scene.										
#	Y	Category #	O	P, W, S, D	Feedback on Step 1 Challenges					
1					Yes - challenge has a chance of occurring Perhaps - meaning is ambiguous Why - challenge does not relate to future scene Solution - statement is a solution to a challenge Duplicate - challenge too similar to another 'Yes' challenge					
2										
3										
4										
5										
6										
7										
8					Category List 1. Arts & Aesthetics 11. Law & Justice 2. Basic Needs 12. Miscellaneous 3. Business & Commerce 13. Physical Health 4. Communication 14. Psychological Health 5. Defense 15. Recreation 6. Economics 16. Social Relationships 7. Education 17. Technology 8. Environment 18. Transportation 9. Ethics & Religion 10. Government & Politics					
9										
10										
11										
12										
13										
14										
15										
16										
Step 1 Scores		Fluency (1-10)		Flexibility (1-10)		Clarity (1-10)		Originality (3)		Total

Step 2 Scoring Guidelines														
Condition Phrase Score	Not present 0	Inaccurate information or unrelated to KVP 1	Present, accurate, and related to future scene 2											
Stem and KVP Score	Key verb phrase not present 0	Present but multiple verb phrases 1	Present but multiple objects or modifiers 2		Present and contains a single active verb phrase 3									
Purpose (P) Score	Not present 0	Present but more than one or repeats KVP 1	Present but no clear relationship to KVP 2		Present and singular with logical relation to KVP 3									
Future Scene Parameters Score	0 or 1 Parameter present 0	2 Parameters present 1		Topic, place, and time present 2										
Focus of Underlying Problem Score	Restates, broadens, or ignores FS 1 No purpose or not connected to KVP; Purpose repeats KVP and/or CP 1 2 3	Too broad or too narrow KVP with stated purpose; UP not clearly worded; multiple KVP or purpose 4 5 6			UP contains a good KVP, the goal or purpose is evident and addresses future scene charge 7 8		Excellent KVP that ties directly into a well defined, clearly written purpose and addresses Future Scene charge 9 10							
Adequacy/Importance of Underlying Problem Score	Restates, broadens, or ignores FS 1 No purpose or not connected to KVP; Purpose repeats KVP and/or CP 1 2 3	Identifies minor issue from the Future Scene 4 5 6			Identifies an appropriate issue from the Future Scene 7 8		Identifies a major, important issue from the Future Scene 9 10							
Step 2 Scores		Condition (0-2)		Stem/KVP (0-3)		Purpose (0-3)		FSP (0-2)		Focus (1-10)		Adequacy (1-10)		Total

Condition Phrase: _____

Stem (circle): "How might we" or "In what ways might we" _____

Key Verb Phrase (KVP): _____

Purpose: _____

Future Scene Parameters: Topic _____ Place _____ Time _____

Comments: _____

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Step 3 Scoring Guidelines	
Fluency - A relevant solution idea addresses the KVP and supports the purpose Score	Fluency is determined by totaling the number of relevant solution ideas and using the following scale: Number of relevant solution ideas: 1 2 3 4 5-6 7-8 9-10 11-12 13-14 15-16 Number of points awarded: 1 2 3 4 5 6 7 8 9 10
Elaboration - Any relevant solution idea that includes at least 3 who, what, why, how, where and when elements Score	Elaboration is determined by totaling the number of elaborated solutions in relevant solution ideas: Number of elaborated solution ideas: 1 2 3 4 5-6 7-8 9-10 11-12 13-14 15-16 Number of points awarded = 1 2 3 4 5 6 7 8 9 10
Flexibility - Measures the number of different categories in relevant solution ideas Score	Flexibility is determined by totaling the number of different categories identified. Number of categories: 1 2 3 4 5 6 7 8 9 10 Number of points awarded = 1 2 3 4 5 6 7 8 9 10
Originality - Three bonus points may be awarded to any relevant solution idea that shows unique creativity or insight	

#	R	E	Category	O	P, W, or D	Feedback on Step 3 solution ideas
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

Category List

1. Arts & Aesthetics	11. Law & Justice
2. Basic Needs	12. Miscellaneous
3. Business & Commerce	13. Physical Health
4. Communication	14. Psychological Health
5. Defense	15. Recreation
6. Economics	16. Social
7. Education	17. Technology
8. Environment	18. Relationships
9. Ethics & Religion	
10. Government & Politics	18. Transportation

Step 3 Scores	Fluency (1-10)	Elaboration (1-10)	Flexibility (1-10)	Originality (2)	Total
Comments:					

Steps 4-5 Scoring Guidelines	
Correctly Written (CW) Measure of degree, single dimension, worded in desired direction Score	One point is awarded for each correctly written criterion. A correctly written criterion MUST include all three: a superlative - 'st' word, focus on a single dimension, and phrased in the desired direction. Number of correctly written criteria = 0 1 2 3 4 5
Relevance to the UP Score	Total Relevancy Points from the table below 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Correctly Used	Grid has 3 or more errors; top solution not used in Step 6	Grid contains 2 errors	Grid contains 1 error	Grid contains no errors
Score	1 2	3	4	5

Step 4-5 Scores	Correctly Written (0-5)	Relevance (0-5)	Correctly Used (1-5)	Total Points

CW (✓)	A = Advanced 3 points	M = Modified 2 points	G = Generic 1 point	D = Duplicate 0 points	NR = Not Relevant 0 points	A / M / G / D / NR	Rel Pts	Steps 4-5 Comments:
1								
2								
3								
4								
5								
Total								

Step 6 Scoring Guidelines									
Relevance - Measures the plan's relationship to the Underlying Problem Score	<table border="1" style="width: 100%;"> <tr> <td>Action Plan does not address the UP</td> <td>Action Plan has some relation to the UP, another solution might be better</td> <td>Action Plan does a good job of addressing the UP</td> <td>Action Plan has an excellent relationship to the UP</td> </tr> <tr> <td>1</td> <td>2 3</td> <td>4</td> <td>5</td> </tr> </table>	Action Plan does not address the UP	Action Plan has some relation to the UP, another solution might be better	Action Plan does a good job of addressing the UP	Action Plan has an excellent relationship to the UP	1	2 3	4	5
Action Plan does not address the UP	Action Plan has some relation to the UP, another solution might be better	Action Plan does a good job of addressing the UP	Action Plan has an excellent relationship to the UP						
1	2 3	4	5						
Effectiveness - Measures the potential ability of the Action Plan to successfully solve the UP Score	<table border="1" style="width: 100%;"> <tr> <td>Action Plan does little to solve the UP</td> <td>Action Plan solves some aspects of UP</td> <td>Action Plan adequately solves UP</td> <td>Action Plan completely solves UP</td> </tr> <tr> <td>1</td> <td>2 3</td> <td>4</td> <td>5</td> </tr> </table>	Action Plan does little to solve the UP	Action Plan solves some aspects of UP	Action Plan adequately solves UP	Action Plan completely solves UP	1	2 3	4	5
Action Plan does little to solve the UP	Action Plan solves some aspects of UP	Action Plan adequately solves UP	Action Plan completely solves UP						
1	2 3	4	5						
Impact - Measures the positive effect of the Action Plan on the future scene Score	<table border="1" style="width: 100%;"> <tr> <td>Action Plan has no effect; UP scored low in adequacy</td> <td>Effect on the future scene is not strong; UP low in adequacy</td> <td>Action Plan has effect on future scene; UP of average adequacy</td> <td>Plan has strong impact on future scene; UP high in adequacy</td> </tr> <tr> <td>1</td> <td>2 3</td> <td>4</td> <td>5</td> </tr> </table>	Action Plan has no effect; UP scored low in adequacy	Effect on the future scene is not strong; UP low in adequacy	Action Plan has effect on future scene; UP of average adequacy	Plan has strong impact on future scene; UP high in adequacy	1	2 3	4	5
Action Plan has no effect; UP scored low in adequacy	Effect on the future scene is not strong; UP low in adequacy	Action Plan has effect on future scene; UP of average adequacy	Plan has strong impact on future scene; UP high in adequacy						
1	2 3	4	5						

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Humaneness - Measures the productive, positive potential of the Action Plan Score	Negative or destructive Action Plan 1 2	Action Plan is neutral - neither positive nor negative 3	Constructive potential evident 4	Action Plan is positive and constructive 5		
Development of Action Plan - The degree to which the team explains its plan Score	Minimal description of plan; rewrite of Step 3 solution idea 1 2 3	Plan provides some elaboration; more support of ideas needed 4 5 6	Plan explains the who, what, why, and how in detail 7 8	Plan structured and well elaborated detailing more than the basic W-W-W-H elements 9 10		
Step 6 Scores	Relevance (1-5)	Effectiveness (1-5)	Impact (1-5)	Humaneness (1-5)	Dev. Action Plan (1-10)	Total
Steps 6 Comments:						
						Total Score
						Team # _____
						Total Points _____ Rank in sample _____

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Appendix B: Cover Letter and Consent Form (Affiliate Director)



Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

Affiliate Director Information Form to Participate in a Research Study

Dear Future Problem Solving Program Affiliate Director,

I am a doctoral candidate in instructional leadership at Western Connecticut State University. I am investigating the effects of problem-solving style training on team process skills and student performance in a Future Problem Solving Program scenario.

To collect data for this study, I would like to ask grade 7-12 participants of the Future Problem Solving Program in your district to complete a demographic survey, an assessment of creativity (a total of 45 minutes in length) and a 20-minute questionnaire. FPSP scores will also be provided to the researcher. Coaches will be asked to complete a demographic survey and a questionnaire. Some teams will be asked to participate in a 30-minute follow-up interview. In addition, I would like to ask half of the teams (both coaches and students), to participate in a 20-minute problem-solving styles assessment as well as a two-hour training session about problem-solving styles and teamwork. This will take place during the FPSP program or during non-instructional time. The other teams will receive Future Problem Solving Program research materials. Finally, I will ask the coaches to complete a 1-2 minute log of their lesson each time they meet with a team. A researcher will conduct classroom observations to document the problem-solving activities occurring in the class. If requested, problem-solving styles training will be provided to the other teams after the study is complete.

Individual problem-solving styles and creativity score results will be provided to the students and coaches. Parents may receive this information upon request as well.

I will not use their names or the names of any participants or towns in connection to the study. Only pseudonyms will be used. All students and coaches will be volunteers and may withdraw from the study at any time.

This research project has been reviewed and approved by the WCSU Institutional Review Board. If you have questions concerning the rights of the subjects involved in research studies please contact the WCSU Assurances Administrator at irb@wcsu.edu and mention Protocol Number 1213-05. This study is valid until September 1, 2013.

If you agree that members of your Affiliate may participate in this research study, please print and sign your name on the following page.

Sincerely,

Laura F. Main
Doctoral Candidate, EdD
in Instructional Leadership
main008@connect.wcsu.edu

Marcia Delcourt, PhD
Coordinator, EdD
in Instructional Leadership
delcourtm@wcsu.edu

If you agree that members of your Affiliate may participate in this research study, please print and sign your name below.

I am at least 18 years of age. _____

Print Name

Signature

Date

Please return this form to the researcher in the self-addressed stamped envelope that is provided.

Appendix C: Cover Letter and Consent Form (Administrator)



Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

Administrator Information Form to Participate in a Research Study

Dear Superintendent/Principal,

I am a doctoral candidate in instructional leadership at Western Connecticut State University. I am investigating the effects of problem-solving style training on team process skills and student performance in a Future Problem Solving Program scenario.

To collect data for this study, I would like to ask grade 7-12 participants of the Future Problem Solving Program in your district to complete a demographic survey, an assessment of creativity (a total of 45 minutes in length) and a 20-minute questionnaire. FPSP scores will also be provided to the researcher. Coaches will be asked to complete a demographic survey and a questionnaire. Some teams will be asked to participate in a 30-minute follow-up interview. In addition, I would like to ask half of the teams (both coaches and students), to participate in a 20-minute problem-solving styles assessment as well as a two-hour training session about problem-solving styles and teamwork. This will take place during the FPSP program or during non-instructional time. The other teams will receive Future Problem Solving Program research materials. Finally, I will ask the coaches to complete a 1-2 minute log of their lesson each time they meet with a team. A researcher will conduct classroom observations to document the problem-solving activities occurring in the class. If requested, problem-solving styles training will be provided to the other teams after the study is complete.

Individual problem-solving styles and creativity score results will be provided to the students and coaches. Parents may receive this information upon request as well.

I will not use the names of any participants, schools, or towns in connection to the study. Only pseudonyms will be used. All students and coaches will be volunteers and may withdraw from the study at any time.

This research project has been reviewed and approved by the WCSU Institutional Review Board. If you have questions concerning the rights of the subjects involved in research studies please contact the WCSU Assurances Administrator at irb@wcsu.edu and mention Protocol Number 1213-05. This study is valid until September 1, 2013.

If you agree that members of your district or school may participate in this research study, please print and sign your name on the following page.

Sincerely,

Laura F. Main
Doctoral Candidate, EdD
in Instructional Leadership
main008@connect.wcsu.edu

Marcia Delcourt, PhD
Coordinator, EdD
in Instructional Leadership
delcourtm@wcsu.edu

If you agree that members of your district or school may participate in this research study, please print and sign your name below:

Print Name

Signature

Date

Please return this form to the researcher in the self-addressed stamped envelope that is provided.

Appendix D: Cover Letter and Consent Form (Coach)



Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

Coach Information Form to Participate in a Research Study

Dear Future Problem Solving Program Coach,

I am a doctoral candidate in instructional leadership at Western Connecticut State University. I am investigating the effects of problem-solving style training on team process skills and student performance in a Future Problem Solving Program scenario.

To collect data for this study, I would like to ask grade 7-12 participants of the Future Problem Solving Program in your district to complete a demographic survey, an assessment of creativity (a total of 45 minutes in length) and a 20-minute questionnaire. FPSP scores will also be provided to the researcher. Coaches will be asked to complete a demographic survey and a questionnaire. Some teams will be asked to participate in a 30-minute follow-up interview. In addition, I would like to ask half of the teams (both coaches and students), to participate in a 20-minute problem-solving styles assessment as well as a two-hour training session about problem-solving styles and teamwork. This will take place during the FPSP program or during non-instructional time. The other teams will receive Future Problem Solving Program research materials. Finally, I will ask the coaches to complete a 1-2 minute log of their lesson each time they meet with a team. A researcher will conduct classroom observations to document the problem-solving activities occurring in the class. If requested, problem-solving styles training will be provided to the other teams after the study is complete.

Individual problem-solving styles and creativity score results will be provided to you and your students. Parents may receive this information upon request as well.

I will not use your name or the names of any participants, schools or towns in connection to the study. Only pseudonyms will be used. You will be a volunteer. You are free to indicate if you do not want to respond to a specific question or set of questions and you may withdraw from the study at any time.

This research project has been reviewed and approved by the WCSU Institutional Review Board. If you have questions concerning the rights of the subjects involved in research studies please contact the WCSU Assurances Administrator at irb@wcsu.edu and mention Protocol Number 1213-05. This study is valid until September 1, 2013.

If you agree to participate in this research study, please print and sign your name on the next page.

Sincerely,

A handwritten signature in purple ink that reads "Laura F. Main".

Laura F. Main
Doctoral Candidate, EdD
in Instructional Leadership
main008@connect.wcsu.edu

A handwritten signature in black ink that reads "Marcia Delcourt".

Marcia Delcourt, PhD
Coordinator, EdD
in Instructional Leadership
delcourtm@wcsu.edu

If you agree to participate in this research study as a coach, please print and sign your name on the next page.

I am at least 18 years of age. _____

Print Name

Signature

Date

Appendix E: Cover Letter and Consent form (Parent)



Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

Parent Information Form to Participate in a Research Study

Dear Parent/Guardian of Future Problem Solving Program Participant,

I am a doctoral candidate in instructional leadership at Western Connecticut State University. I am investigating the effects of problem-solving style training on team process skills and student performance in a Future Problem Solving Program scenario.

To collect data for this study, I would like to ask your child to complete a demographic survey, an assessment of creativity (a total of 45 minutes in length) and a 20-minute questionnaire. FPSP scores will also be provided to the researcher. Some teams will be asked to participate in a 30-minute follow-up interview. In addition, I would like to ask half of the teams (both coaches and students), to participate in a 20-minute problem-solving styles assessment as well as a two-hour training session about problem-solving styles and teamwork. This will take place during the FPSP program or during non-instructional time. The other teams will receive Future Problem Solving Program research materials. If your child's team is not selected for the problem-solving styles training, but you would like your child to receive it after the qualifying problem is due, I will be happy to provide that opportunity. A researcher will conduct classroom observations to document the problem-solving activities occurring in the class. Finally, each time the coach meets with your child, he/she will complete a 1-2 minute log of the lesson plan.

Individual problem-solving styles and creativity score results will be provided to your child's coach and your child. I will be happy to review the results of the creativity assessment or the problem-solving styles assessment with you if you are interested.

I will not use your child's name or the names of any participants, schools or towns in connection to the study. Only pseudonyms will be used. Your child will be a volunteer. You or your child are free to indicate if you do not want to respond to a specific question or set of questions, and you may withdraw your child from the study at any time.

This research project has been reviewed and approved by the WCSU Institutional Review Board. If you have questions concerning the rights of the subjects involved in research studies please contact the WCSU Assurances Administrator at irb@wcsu.edu and mention Protocol Number 1213-05. This study is valid until September 1, 2013.

If you agree to allow your child to participate in this research study, please print and sign your name on the following page.

Sincerely,

A handwritten signature in purple ink that reads "Laura F. Main".

Laura F. Main
Doctoral Candidate, EdD
in Instructional Leadership
main008@connect.wcsu.edu

A handwritten signature in black ink that reads "Marcia Delcourt".

Marcia Delcourt, PhD
Coordinator, EdD
in Instructional Leadership
delcourtm@wcsu.edu

If you agree to allow your child to participate in this research study, please print and sign your name below.

Name of Child _____

Print Name

Signature

Date

Appendix F: Cover Letter and Assent Form (Student)



Department of Education and Educational Psychology
181 White Street
Danbury, CT 06810

Student Information Form to Participate in a Research Study

Dear Future Problem Solving Program Student,

I am a doctoral candidate in instructional leadership at Western Connecticut State University. I am investigating the effects of problem-solving style training on team process skills and student performance in a Future Problem Solving Program scenario.

To collect data for this study, I would like to ask you to complete a survey about yourself, an assessment of creativity (a total of 45 minutes in length) and a 20-minute questionnaire. FPSP scores will also be provided to me. Some teams will be asked to participate in a 30-minute follow-up interview. In addition, I would like to ask half of the teams (both coaches and students), to participate in a 20-minute problem-solving styles assessment as well as a two-hour training session about problem-solving styles and teamwork. This will take place during the FPSP program or during non-instructional time. The other teams will receive Future Problem Solving Program research materials. If your team is not selected for the problem-solving styles training, but you would like to receive it after the qualifying problem is due, I will be happy to provide that opportunity. A researcher will conduct classroom observations to record the activities your coach is doing with you, and each time you meet with your coach, he/she will complete a 1-2 minute log of the activities.

Your problem-solving styles and creativity score results will be provided to both you and your coach. I will also provide them to your parents if they are interested.

I will not use your name or the names of any participants, schools or towns in connection to the study. Only pseudonyms will be used. You will be a volunteer. You are free to indicate if you do not want to respond to a specific question or set of questions, and you may withdraw from the study at any time.

This research project has been reviewed and approved by the WCSU Institutional Review Board. If you have questions concerning the rights of the subjects involved in research studies please contact the WCSU Assurances Administrator at irb@wcsu.edu and mention Protocol Number 1213-05. This study is valid until September 1, 2013.

If you agree to participate in this research study, please sign your name on the next page.

Sincerely,

A handwritten signature in purple ink that reads "Laura F. Main".

Laura F. Main
Doctoral Candidate, EdD
in Instructional Leadership
main008@connect.wcsu.edu

A handwritten signature in black ink that reads "Marcia Delcourt".

Marcia Delcourt, PhD
Coordinator, EdD
in Instructional Leadership
delcourtm@wcsu.edu

If you agree to participate in this research study, please print and sign your name below.

Print Name

Signature

Date

Appendix G: Auditor's Report

Western Connecticut State University
EdD in Instructional Leadership Program
Auditor Report

As the auditor, I reviewed Laura's dissertation along with qualitative data that were provided.

As a result of the review the following conclusions were reached:

1. Agreement about the meaning of all coding terms and the codes themselves was reached. The process of coding terms and the codes that were developed followed a logical progression.
2. During the audit several sections were examined and coded. Along with the researcher, I examined random sections of data for consistency of coding and theme. Clarifying questions that were asked were explained by the researcher and we reached agreement.
3. An explanation for the type of coding was provided and explained in a consistent and rationale manner.
4. The quantitative and qualitative results were accurately used to triangulate the data. The results reported were appropriate in relation to the analysis of the data. The findings reported described that more participants in the treatment group related to an understanding of self and others while participants from the comparison group made more statements than the treatment group about the technical aspects of Future Problem Solving Program. These conclusions were consistent with the analysis of the data

In conclusion, the audit revealed no issues with coding, analysis, or interpretation. The researcher presented a thorough and accurate description that was logical to follow.

If you have any questions regarding this report, please contact me.

Dr. Andrew Cloutier
Social Studies Instructional Leader
Middlebrook School
131 School Road
Wilton, CT
203.762.8388
cloutiera@wilton.k12.ct.us

Appendix H: Coach Demographic Information

DEMOGRAPHIC INFORMATION: COACH

Please complete both pages.

1. First Name _____ Last Name _____
2. Circle one: Male Female
3. Town _____
4. School _____
5. Phone Number _____
6. Email Address _____
7. # of Years of Coaching Experience with the Future Problem Solving Program _____
8. Are you a teacher?
 - a. Circle one: Yes No
 - b. If yes, Number of Years as a Teacher _____
9. How many teams do you plan to coach this year? _____
10. Circle the Day(s) of Week the teams meet:
Monday Tuesday Wednesday Thursday Friday
11. Provide the time(s) teams meet _____
12. Location of Team Meetings _____
13. Are you willing/able to keep your team(s) intact from November-February?
 - a. Circle one: Yes No Not Sure
 - b. If you indicated no or not sure, what might be some of the factors that could interfere with maintaining intact teams?

14. Are teams able to participate in a two-hour training during school or outside of school hours?

a. Circle one: Yes No Not Sure

b. If you indicated no or not sure what might be some of the factors that could interfere?

15. Describe any training you have had that you think contributes to your success as a coach:

16. Please explain anything else you feel may be important for the researcher to know about your teaching or coaching experience:

Appendix I: Student Demographic Information

DEMOGRAPHIC INFORMATION: STUDENT

Please complete.

1. First Name _____ Last Name _____
2. Circle one: Male Female
3. Birthdate ____ / ____ / ____
4. Grade Level _____
5. Name of Parent(s)/Guardian(s):

6. Name of Coach _____
7. Town _____
8. Name of School _____
9. Email address _____
10. Parent Email Address _____
11. Number of Years of Experience with the Future Problem Solving Program _____

Appendix J: Coach's Log

Coach's Log

Directions: Please complete one coach's log per team. Log each session below.

Name of Coach _____

School _____

Type of Group: Circle one.

VIEW

Research

Names of Students on Team _____

Date	Length of Session	Notes (e.g. absent student, fire drill)	List of Lesson Activities	Comments

Appendix K: Questionnaire

Appendix L: Sample Semi-Structured Team Interview Questions

Semi-Structured Team Interview Questions: Students

1. How do you perceive your experience in having been involved with a Future Problem Solving Program Global Issues Problem Solving Team?
2. What would you say were your strengths on the team?
3. What contributed to your individual success on the team?
4. Did your team encounter any difficulties working together as a group? If so, how were these difficulties dealt with? Were they resolved? How?
5. What other experiences or support would have contributed to furthering your success on the team?
6. Now that you are finished with the program, what would you say you have gained from the experience of having participated on this team?
7. What have you learned that you can apply to other group problem-solving situations you might encounter in school or in your life?
8. Based on your experiences with this program, do you think all students would benefit from this? Why or why not?
9. What do you think the ideal creative problem-solving program should be like?
10. What advice would you give to a new FPSPI team?
11. What advice would you give to a new individual on an FPSPI team?
12. If given the opportunity, would you join an FPSPI team in the future? Why or why not?

APPENDIX M: Research Support Materials for Megacities

Research Support Materials for Megacities

In addition to the resources provided by FPSPI, these resources may help be helpful:

1. **<http://www.megacitiesproject.org/>**
The Mega-Cities Project is a transnational non-profit network of leaders from grassroots groups, non-profits, government, business, academia and media dedicated to sharing innovative solutions to the problems their cities face in common. We focus on the intersection of poverty/environment with special attention to voice and livelihood for marginalized groups.
2. **<http://megacities.nl/>**
The Megacities Foundation in the Netherlands began as an initiative by UNESCO asking the International Academy of Architecture (IAA) to focus on the problems of the explosively growing megalopoli. Prof. Jan Hoogstad, IAA representative from the Netherlands, started a nuclear group of experts and professionals to develop a programme of activities that would bring the topic of urban development and growth to a wider platform of debate.
3. **<http://www.forumforthefuture.org/project/megacities-move/overview>**
More than half the world's population is living in towns and cities, Megacities on the Move seeks to achieve sustainable urban mobility in the context of rapid urbanization.
4. **<http://www.forumforthefuture.org/blog/megacities-move-audio-slideshow>**
Megacities on the Move audio slideshow
5. **<http://megacities.usc.edu/>**
Headquartered at the University of Southern California, the Center on Megacities develops innovative solutions for megacities through interdisciplinary expertise in science and engineering, including civil and environmental engineering, information technology, architecture, economics, social science, policy and planning, and public health.
6. **<http://ngm.nationalgeographic.com/ngm/0211/feature3/>**
By 2030, two out of three people will live in an urban world, with most of the explosive growth occurring in developing countries. For a preview of the future, the last in the Challenges for Humanity series explores São Paulo, Brazil; Lagos, Nigeria; Bangkok, Thailand; and Hyderabad, India.

APPENDIX N: VIEW Training Activity: What is Your Style?

What is Your Style?

Purpose: To provide individuals an opportunity to explore their VIEW preferences after hearing a presentation about each of VIEW's three dimensions. To help establish an informal, personal, and concrete frame of reference for understanding VIEW results.

Materials:

- VIEW Overview Power Point
- Copies of the "What is your style?" worksheet (one per participant)
- Individual 4-page reports of the VIEW results for each participant

Activity Steps:

1. Discuss Orientation to Change characteristics, benefits and risks and ask participants to mark on a worksheet where on the continuum they feel they belong between Explorer and Developer. In addition, ask them to write a short example that describes their style.
2. Repeat for Manner of Processing and Ways of Deciding dimensions.
3. Hand out individual feedback forms. Ask students to read forms and compare the results with their informal assessment on the worksheet.
4. Discuss whether informal assessments agreed with VIEW scores.
5. Discuss participants' reaction to the activity.

Adapted from the original lesson developed by Dr. Ed Selby in Selby, Treffinger, Isaksen (2011. pp. 7-55-7-57) by permission from the authors

APPENDIX O: VIEW Training Activity: Signatures

Signatures

Purpose: To demonstrate that style deals with preference rather than ability

Materials:

- Copies of two blank checks (one copy per participant)

Activity Steps:

1. Instruct participants to take pen in hand and sign the first check.
2. Instruct participants to take their pen in the opposite hand and sign the second check.
3. Ask participants if they were able to do the task both times.
4. Ask, “Which was easier?” “Which took longer?” “Are you equally pleased with the results from both times?” “How will your bank feel about honoring the second check?”
5. Discuss that the second trial was not impossible, but the first was a more natural, smooth, comfortable, efficient approach. The other way was contrived, difficult, less efficient and less effective.
6. Ask participants to share group experiences where they benefitted from being able to apply their style preferences or were hindered by limitations that prevented them from applying their own style preferences to the task(s).

Adapted from the original lesson by Selby, Treffinger, Isaksen (2011. pp. 7-39-7-40)
by permission from the authors

APPENDIX P: VIEW Training Activity: Style-alike Group Activity

Style-alike Group Activity

Purpose: To demonstrate that individuals with similar style preferences share ways they prefer to approach change, process information and make decisions, and then to experience the similarities and differences described by other groups.

Materials:

- Prearranged groups with similar style preferences without referencing what they are
- Chart paper
- Markers

Activity Steps:

1. Assign groups.
2. Ask participants to discuss four questions and to capture the key elements of their responses on chart paper (to be shared later with the entire group).
 - a. How do you deal with open-ended problems or with change? What do the members of your group seem to have in common in this regard?
 - b. What are the pluses of those common ways of dealing with change? What strengths do you share as a group?
 - c. What are the minuses of these commonalities?
 - d. What kinds of behavior by teammates when working in a group is most difficult for you to understand and deal with in relation to responding to problem-solving and dealing with change?
3. Provide 15-20 minutes for the groups to answer the questions and 5-10 minutes to prepare the charts.
4. Ask the groups to report in a sequence so that opposite styles follow one another.
5. After all of the groups have shared, ask people to look for main ideas that synthesize the similarities and differences.

Adapted from the original lesson developed by Selby, Treffinger, Isaksen (2011. pp. 7-41-7-42) by permission from the authors

APPENDIX Q: VIEW Training Activity: The Team Slogans Activity

The Team Slogans Activity

Purpose: To enhance participants' understanding of style and guide them to consider implications of style dimensions in their interactions with others.

Materials:

- Teams of participants that regularly work together
- Sentence Strips (4 per group)
- Markers

Activity Steps:

1. Have individuals voluntarily discuss their style preferences in the Orientation to Change dimension with team members.
2. Ask group to create a slogan that describes their team in the Orientation to Change dimension.
3. Repeat #1 and #2 for Manner of Processing and Ways of Deciding.
4. Share slogans with other teams that were posted by each groups.
5. Discuss implications for teams that have individuals with opposing style preferences.
6. Discuss implications with teams that have individuals with similar style preferences.
7. Discuss whether the slogans represented the positive aspects of the team or not.
8. Ask teams to come up with a team name by combining the information of all three slogans.
9. Share team names and discuss potential strengths and weaknesses of teams based on style preferences.

Adapted from original lesson, "The Style Slogans Activity" developed by Laurie Abeel, John Houtz, Yung Che Kim, Ed Selby, and Dave Zmudka in Selby, Treffinger, Isaksen (2011. pp. 7-43-7-44) by permission from the authors

Appendix R: VIEW Participant Predictions: Orientation to Change

VIEW Participant Predictions: Orientation to Change

Style Preference	VIEW score	Explanation/Example
Strong Explorer Preference	30	I like to find new ways of solving problems. Don't like structure.
	48	I never like to do the same things. For example, if we are choosing a restaurant, I usually prefer an option we have never been before for a change. I also don't conform with ideas or clothing.
	50	I really like to do things "differently" and without structure
	54	Once given my boundaries, I feel free to do whatever necessary to solve the problem.
	57	I like to be creative and "bend" ALL the rules. I love finding loopholes. I always ask WHY? (I don't like ORDER.)
Slight Explorer Preference	60	Independent, don't always face the problem right away
	67	Both apply but I do like to challenge problems and stretch rules
	68	I like to find unique directions to take a problem and think outside the box. I'm always asking "why."
Moderate	71	I prefer more to be unique and creative when solving problems, though I also appreciate structure.
	74	I find that in school and were doing projects, classwork, etc, I find I enjoy having the security and stability of guidelines. I also like asking why and how.

(continued)

VIEW Participant Predictions: Orientation to Change

Style Preference	VIEW score	Explanation/Example
Slight Developer Preference	74	I think that I prefer to have structure. I ask a lot of questions on how to do things.
	76	I prefer to have guidelines, but not too many rules/constraints.
	78	I prefer structure and definition in tasks.
	80	The benefits of structure: precise, thorough, dependable.
Strong Developer Preference	85	I like to work within the boundaries of a problem while I am working on it.
	88	I prefer to follow the rules and very rarely take on the original and unique.
	89	I like to make sure that I am following the rules and doing nothing wrong, so I tend not {to} think "outside the box." I like the accuracy of information.
	91	I like to have structure and organization.
	91	{Whenever} the problem gives me the rules, I use them.
	95	I like everything to be precise, not thinking out of the box.
	97	I generally like to start a project or work based off of a pre-existing structure, even if I'm not being confined by rules.

(continued)

VIEW Participant Predictions: Orientation to Change

Style Preference	VIEW score	Explanation/Example
Strong Developer Preference	102	I tend to like to work within structure, and I work with what I have by trying to improve things and be precise.
	102	I like to come up with new ideas, but I am most comfortable with limits and rules that I can work with.
	116	When given an assignment, the clearer and more specific the instructions are, the happier I am.

Appendix S: VIEW Participant Predictions: Manner of Processing

VIEW Participant Predictions: Manner of Processing

Style Preference	VIEW score	Explanation/Example
Strong External Preference	8	I know I love working with people. People allow me to get excited and keep pouring out ideas. I do NOT work well alone.
	19	Like to talk it out with others. Must think and talk at the same time.
	20	I immediately want to brainstorm with my group and bounce off ideas. I need to hear their thoughts and discuss in depth.
Slight External Preference	22	Independent, don't always face the problem right away
	23	Both apply but I do like to challenge problems and stretch rules
	23	I like to find unique directions to take a problem and think outside the box. I'm always asking "why."
Moderate	25	I think of lots of ideas and have many opinions when I'm with others, but I can only focus and take things seriously when I'm alone.
	27	Sometimes I like to hear from others. Sometimes I like to focus solely on my own.
	28	I consider what people think about decisions, but I also try to convince people that my idea is logical. I make sure that everyone agrees on a decision before moving forward, but make sure the decision is logical and practical.
	29	Pretty indecisive. Avoid conflict.

(continued)

VIEW Participant Predictions: Manner of Processing

Style Preference	VIEW score	Explanation/Example
Moderate	29	I like to run my ideas over with others; however I really enjoy concentrating by myself.
	29	I always feel comfortable sharing ideas and working with others, and I don't really like being separated from people for long times.
Slight Internal Preference	30	I like to process information internally, but I always prefer to share ideas and talk about them in a group.
	33	I can work with people well, but I like to think through ideas.
	34	I prefer developing my own ideas before jumping to conclusions or going to others.
	35	I am often quiet and prefer thinking things over in my head, although I'm not completely opposed to talking in groups.
	36	I like to concentrate quietly by myself, and I like to decide things on my own, as I can be extremely independent..
Strong Internal Preference	40	Although I find discussion and sharing opinions and important part of the problem, I just like to go into quiet and really think.
	40	I prefer to think about things and work on my own before with other people.
	41	I prefer to work by myself instead of with others.
	42	I prefer to bounce ideas off of myself.
	43	I prefer to think to myself in silence, but I do like to discuss with others at times.

Appendix T: VIEW Participant Predictions: Ways of Deciding

VIEW Participant Predictions: Ways of Deciding

Style Preference	VIEW score	Explanation/Example
Strong Person-Focused Preference	29	I always try to make sure everyone in my group is happy, and I go along so that [there] will be no conflicts.
Slight Person-Focused Preference	30	I want to think about my ideas, but then share them with the group to make sure that I am doing everything the right way.
	30	I do promote logical thinking, but when doing group work it is important to be in harmony.
	31	I usually like to follow and go with ideas that keep everyone happy and keep everything comfortable.
Moderate	33	Neither: Not person or task focused
	33	I'm not afraid to tell someone if [their] idea is bad, but I also do not always focus on what's logical. I am in the middle.
Slight Task-Focused Preference	33	I always consider the impact of emotions and feelings, but I don't let it cloud my ability to think logically.
	36	I try to isolate the issue at hand.
	38	I like rational, logical decisions; however, I do take people into slight consideration.
	39	Both apply but I do feel I am more logical when it comes to decisions.

(continued)

VIEW Participant Predictions: Ways of Deciding

Style Preference	VIEW score	Explanation/Example
	40	I am a very logical thinker, but I do consider people's feelings within a problem.
	40	I feel like I have the rational and logical thinking for a "task" person, but I also understand the human factors and implications.
	40	I don't like to ignore people's feelings, but I would rather use logic because getting good scores and doing well is most important.
	40	Although I find it important to make sure people are comfortable, I find it much more important to be logical and find good solutions that make the most sense even though it might be a little critical.
Strong Task-Focused Preference	42	Although I find discussion and sharing opinions and important part of the problem, I just like to go into quiet and really think.
	42	I prefer to think about things and work on my own before with other people.
	45	I prefer to work by myself instead of with others.
	52	I prefer to bounce ideas off of myself.

APPENDIX U: Master Code List

Master Code List

1. Ability
2. Absent for QP
3. Accepting ideas of others: challenging
4. All students
5. All students if willing
6. Allocation of time
7. Analyze a situation
8. Application of VIEW training
9. Appreciate others
10. Articulation of ideas
11. Basis of success
12. Better challenges needed
13. Better ideas
14. Booklets
15. Bounce ideas
16. Brainstorming
17. Broad/specific balance
18. Can't force others
19. Clear writing
20. Commitment needed
21. Communication
22. Compromise
23. Compromise or vote
24. Confer with each other

25. Confidence
26. Conflicts not handled
27. Connections to Underlying Problem
28. Cooperation
29. Coordination
30. Coordination: more needed
31. Creative ideas
32. Creative reasoning
33. Creative thinking
34. Critical friends
35. Dependency on one teammate
36. Depends on type of student
37. Determination
38. Developing criteria
39. Didn't do research
40. Different from group
41. Different ideas
42. Different views
43. Disagreement
44. Discussion and resolution
45. Divided roles
46. Don't realize you are using it
47. Duplicates
48. Efficiency
49. Elaboration

50. Encourage participation
51. Evaluation skills
52. Everyone knows how to do everything
53. Exhausting
54. Factor in performance
55. Failure to communicate
56. Filling in the gaps
57. Flexibility
58. Fluency
59. Foresight
60. Forming teams
61. FPSPI process
62. Friends
63. Generating challenges
64. Gifted students
65. Good challenges
66. Good ideas
67. Good research
68. Good to be creative
69. Graded with experience as a factor
70. Grid
71. Guidance
72. Handling conflicts
73. Hard at first
74. Helped understand reasoning

75. High standards
76. Honesty
77. Identification
78. Improved over time
79. Included all
80. Independent work
81. Interpretation from varied POV
82. Jumping in and then going back to work
83. Justifying
84. Keep group on track
85. Kept quiet
86. Know strengths
87. Know strengths and weaknesses
88. Know weaknesses
89. Know who is good at what
90. Knowing the FPSPI process
91. Knowledge of topics: strong
92. Knowledge of topics: varied within team
93. Knowledge of topics: weak
94. Lack of clarity
95. Lack of experience
96. Learn about the real world
97. Learn as you go
98. Limited fluency
99. Make sense of problem

100. Mediator
101. Meeting outside of class before competition
102. Meticulous
103. More research needed
104. Most well-rounded product
105. Need stamina
106. Need to research
107. Needed help at beginning
108. Needs to be more open
109. Never know what one team member is doing
110. New freshman
111. No arguments
112. No transfer when in a different group
113. Not afraid to be creative
114. Number
115. Open mind
116. Openness
117. Optimism
118. Pacing
119. Perception is not reality
120. Planning
121. Poor elaboration
122. Poor group work
123. Practicality
124. Preparation

125. Prevention of duplicates
126. Pre-work
127. Problem identification
128. Proofread
129. Push others to do best
130. Quickly resolve conflicts to save time
131. Quieter work environment
132. Rare conflicts
133. Repetition
134. Review FPSPI process
135. Rewards
136. Scheduling conflict
137. Scoring rules
138. Seeing something from multiple dimensions
139. Selection
140. Selection of most important parts
141. Share ideas
142. Shared effort
143. Similarity of approach: weakness
144. Sloppy
145. Slows down team
146. Solutions
147. Speed sacrificed quality
148. Strengths by steps
149. Stress

150. Strong leader
151. Strongest teams together the longest
152. Systematic
153. Table ideas for later
154. Talking off task
155. Task completion
156. Team make-up matters
157. Team members matter
158. Too broad
159. Too narrow
160. Too out-of-the-box
161. Took a lot of time
162. Transfer: communication with others
163. Transfer: creative problem solving
164. Transfer: learn about self
165. Transfer: other classes
166. Transfer: planning ahead
167. Transfer: project management
168. Transfer: thinking skills
169. Transfer: working with others
170. Transfer: writing skills
171. Trouble picking Underlying Problem
172. Understand differences now
173. Unfocused
174. Value contributions

- 175. Varied perspectives help
- 176. Vocabulary word argument
- 177. Voice opinions
- 178. Voted
- 179. When group changes
- 178. Will continue with course
- 179. Willingness
- 180. Wording
- 181. Work best under time constraints
- 182. Work best when keep on track
- 183. Workhorse
- 184. Work outside comfort zone
- 185. Work together
- 186. Work well together
- 187. Worried about the time
- 188. Writing out ideas

Appendix V: Frequency and Percentage of Responses by Code and Instrument

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Ability	5	83	1	17
Absent for QP	0	0	2	100
Accepting ideas of others: challenging	3	100	0	0
All students	0	0	8	100
All students if willing	0	0	2	100
Allocation of time	21	70	9	30
Analyze a situation	0	0	6	100
Application of VIEW training	1	33	2	67
Appreciate others	0	0	4	100
Articulation of ideas	5	71	2	29
Basis of success	8	67	4	33
Better challenges needed	1	100	0	0
Better ideas	1	20	4	80
Booklets	2	50	2	50
Bounce ideas	6	67	3	33
Brainstorming	20	80	5	20

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Broad/specific balance	2	50	2	50
Can't force others	0	0	4	100
Clear writing	9	100	0	0
Commitment needed	5	83	1	17
Communication	14	100	0	0
Compromise	8	89	1	11
Compromise or vote	3	100	0	0
Confer with each other	13	72	5	28
Confidence	0	0	2	100
Conflicts not handled	3	100	0	0
Connections to Underlying Problem	4	100	0	0
Cooperation	6	100	0	0
Coordination	5	100	0	0
Coordination: more needed	3	100	0	0
Creative ideas	5	100	0	0

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Creative reasoning	4	80	1	20
Creative thinking	12	92	1	8
Critical friends	2	50	2	50
Dependency on one teammate	1	100	0	0
Depends on type of student	0	0	9	100
Determination	4	100	0	0
Developing criteria	4	100	0	0
Didn't do research	6	100	0	0
Different from group	0	0	2	100
Different ideas	4	29	10	71
Different views	12	92	1	8
Disagreement	14	78	4	22
Discussion and resolution	6	60	4	40
Divided roles	56	82	12	18
Don't realize using it	0	0	1	100

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Duplicates	7	78	2	22
Efficiency	8	73	3	27
Elaboration	8	100	0	0
Encourage participation	13	87	2	13
Evaluation skills	3	100	0	0
Everyone knows how to do everything	3	60	2	40
Exhausting	0	0	3	100
Factor in performance	0	0	2	100
Failure to communicate	11	92	1	8
Filling in the gaps	1	50	1	50
Flexibility	4	57	3	43
Fluency	38	84	7	16
Foresight	2	22	7	78
Forming teams	0	0	7	100
FPSPi process	20	61	13	39

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Friends	3	23	10	77
Generating challenges	1	50	1	50
Gifted students	1	100	0	0
Good challenges	5	100	0	0
Good ideas	0	0	2	100
Good research	3	100	0	0
Good to be creative	2	100	0	0
Graded with experience as a factor	0	0	5	100
Grid	2	67	1	33
Guidance	5	100	0	0
Handling conflicts	29	100	0	0
Hard at first	0	0	2	100
Helped understand reasoning	2	67	1	33
High standards	4	100	0	0
Honesty	0	0	2	100

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Identification	6	100	0	0
Improved over time	0	0	8	100
Included all	16	100	0	0
Independent work	9	90	1	10
Interpretation from varied POV	0	0	3	100
Jumping in and then going back to work	0	0	2	100
Justifying	2	100	0	0
Keep group on track	19	76	6	24
Kept quiet	0	0	2	100
Know strengths	5	50	5	50
Know strengths and weaknesses	0	0	2	100
Know weaknesses	2	67	1	33
Know who is good at what	7	26	20	74
Knowing the FPSPI process	2	67	1	33
Knowledge of topics: strong	2	40	3	60

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Knowledge of topics: varied within team	1	100	0	0
Knowledge of topics: weak	6	40	9	60
Lack of clarity	6	100	0	0
Lack of experience	2	17	10	83
Learn about real world	0	0	2	100
Learn as you go	0	0	6	100
Limited fluency	26	96	1	4
Make sense of problem	5	100	0	0
Mediator	4	80	1	20
Meeting outside of class before competition	3	100	0	0
Meticulous	4	100	0	0
More research needed	40	98	1	2
Most well-rounded product	0	0	3	100
Needed help at beginning	1	33	2	67
Need stamina	0	0	1	100

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Needs to be more open	2	100	0	0
Need to research	4	100	0	0
Never know what one team member is doing	0	0	3	100
New freshmen	0	0	3	100
No arguments	8	53	7	47
No transfer other group	0	0	3	100
Not afraid to be creative	0	0	2	100
Number	67	87	10	13
Open mind	2	100	0	0
Openness	2	50	2	50
Optimism	1	100	0	0
Pacing	13	81	3	19
Perception is not reality	1	50	1	50
Planning	7	88	1	12
Poor Elaboration	1	33	2	67

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Poor group work	3	60	2	40
Practicality	3	100	0	0
Preparation	5	100	0	0
Prevention of duplicates	4	80	1	20
Pre-work	5	100	0	0
Problem identification	2	100	0	0
Proofread	4	100	0	0
Push others to do best	0	0	2	100
Quickly resolve conflicts to save time	1	50	1	50
Quieter work environment	1	100	0	0
Rare conflicts	1	50	1	50
Repetition	1	25	3	75
Review FPSPI process	3	100	0	0
Rewards	1	100	0	0
Scheduling conflict	6	86	1	14

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Scoring rules	0	0	3	100
Seeing from multiple dimensions	0	0	3	100
Selection	3	50	3	50
Selection of most important parts	0	0	2	100
Share ideas	3	100	0	0
Shared effort	2	100	0	0
Similarity of approach: weakness	1	100	0	0
Sloppy	4	100	0	0
Slows down team	0	0	1	100
Solutions	20	80	5	20
Speed sacrificed quality	1	100	0	0
Strengths by steps	5	100	0	0
Stress	1	33	2	67
Strong leader	2	100	0	0
Strongest teams together the longest	0	0	4	100

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Systematic	2	100	0	0
Table ideas for later	1	100	0	0
Talking off task	8	53	7	47
Task completion	12	86	2	14
Team make-up matters	0	0	1	100
Team members matter	1	100	0	0
Too broad	2	50	2	50
Too narrow	2	100	0	0
Too out-of-the-box	6	86	1	14
Took a lot of time	3	100	0	0
Transfer: communication with others	0	0	4	100
Transfer: creative problem solving	2	22	7	78
Transfer: learn about self	1	50	1	50
Transfer: other classes	0	0	3	100
Transfer: planning ahead	0	0	2	100

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Transfer: project management	0	0	5	100
Transfer: thinking skills	1	17	5	83
Transfer: working with others	0	0	17	100
Transfer: writing skills	0	0	4	100
Trouble picking UP	8	80	2	20
Understand differences now	1	14	6	86
Unfocused	47	90	5	10
Value contributions	2	50	2	50
Varied perspectives help	0	0	6	100
Vocabulary word argument	0	0	5	100
Voice opinions	7	88	1	12
Voted	5	100	0	0
When group changes	0	0	3	100
Will continue with course	0	0	4	100
Willingness	3	75	1	25

(continued)

Frequency and Percentage of Responses by Code and Instrument

Code	Number from Questionnaire	Percentage from Questionnaire	Number from Interview	Percentage from Interview
Wording	7	100	0	0
Work best under time constraints	1	50	1	50
Work best when keep on track	8	80	2	20
Work outside comfort zone	1	100	0	0
Work together	18	86	3	14
Work well together	21	78	6	22
Workhorse	2	33	4	67
Worried about the time	1	17	5	83
Writing out ideas	1	50	1	50
Total	985	68	472	32

Appendix W: Categories Generated from Codes

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Application	1	Analyze a situation	6	85	51 (60%)	34 (40%)
	2	Can't force others	4			
	3	Confidence	2			
	4	Don't realize using it	1			
	5	Foresight	9			
	6	Learn about real world	2			
	7	No transfer other group	3			
	8	Seeing from multiple dimensions	3			
	9	Selection of most important parts	2			
	10	Team make-up matters	1			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Application	11	Transfer: communication with others	4			
	12	Transfer: creative problem solving	9			
	13	Transfer: learn about self	2			
	14	Transfer: other classes	3			
	15	Transfer: planning ahead	2			
	16	Transfer: project management	5			
	17	Transfer: thinking skills	6			
	18	Transfer: working with others	17			
	19	Transfer: writing skills	4			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Background knowledge	1	Knowledge of topics: strong	5	21	3 (14%)	18 (86%)
	2	Knowledge of topics: varied within team	1			
	3	Knowledge of topics: weak	15			
Cohesiveness	1	Cooperation	6	53	27 (51%)	26 (49%)
	2	Factor in performance	2			
	3	Friends	13			
	4	Poor group work	5			
	5	Work well together	27			
Collaboration	1	Articulation of ideas	7	95	45 (47%)	50 (53%)
	2	Bounce ideas	9			
	3	Communication	14			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Collaboration	4	Confer with each other	18			
	5	Included all	16			
	6	Openness	4			
	7	Practicality	3			
	8	Share ideas	3			
	9	Work together	21			
Collegiality	1	Critical friends	4	14	6 (43%)	8 (57%)
	2	Honesty	2			
	3	Voice opinions	8			
Creativity	1	Creative ideas	5	113	59 (52%)	54 (48%)

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group	
Creativity	3	Creative thinking	13				
	4	Flexibility	7				
	5	Fluency	45				
	6	Good to be creative	2				
	7	Not afraid to be creative	2				
	8	Limited fluency	27				
	9	Too out-of-the-box	7				
	Decision-making	1	Compromise	9	46	23 (50%)	23 (50%)
		2	Compromise or vote	3			
3		Discussion and resolution	10				

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Decision-making	4	Selection	6			
	5	Took a lot of time	3			
	6	Trouble picking Underlying Problem	10			
	7	Voted	5			
Discussion	1	Handling conflicts	29	40	24 (60%)	16 (40%)
	2	Helped understand reasoning	3			
	3	Jumping in and then going back to work	2			
	4	Pre-work	5			
	5	Table ideas for later	1			
Experience	1	Graded with experience as a factor	5	41	23 (56%)	18 (44%)

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Experience	2	Hard at first	2			
	3	Improved over time	8			
	4	Knowing the FPSPI process	3			
	5	Lack of experience	12			
	6	Learn as you go	6			
	7	Needed help at beginning	3			
	8	Optimism	1			
	9	Rewards	1			
	Focus	1	Determination	4	70	33 (47%)
2		Perception is not reality	2			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Focus	3	Unfocused	52			
	4	Work best under time constraints	2			
	5	Work best when keep on track	10			
Generating ideas	1	Brainstorming	25	58	24 (41%)	34 (59%)
	2	Filling in the gaps	2			
	3	Generating challenges	2			
	4	Problem identification	2			
	5	Solutions	25			
	6	Writing out ideas	2			
Group composite	1	Forming teams	7	15	10 (67%)	5 (33%)
	2	Strongest teams together the longest	4			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Group composite	3	Team members matter	1			
	4	When group changes	3			
Group discord	1	Conflicts not handled	3	69	42 (61%)	27 (39%)
	2	Disagreement	18			
	3	Failure to communicate	12			
	4	Independent work	10			
	5	Needs to be more open	2			
	6	No arguments	15			
	7	Quickly resolve conflicts to save time	2			
	8	Rare conflicts	2			
	9	Vocabulary word argument	5			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Group diversity	1	Appreciate others	4	56	36 (64%)	20 (36%)
	2	Better ideas	5			
	3	Different from group	2			
	4	Different ideas	14			
	5	Different views	13			
	6	Interpretation from varied POV	3			
	7	Never know what one team member is doing	3			
	8	Similarity of approach: weakness	1			
	9	Slows down team	1			
	10	Value contributions	4			
	11	Varied perspectives help	6			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Leadership	1	Dependency on one teammate	1	41	23 (56%)	18 (44%)
	2	Guidance	5			
	3	Keep group on track	25			
	4	Mediator	5			
	5	Push others to do best	2			
	6	Strong leader	2			
	7	Work outside comfort zone	1			
Listen to others	1	Accepting ideas of others: challenging	3	12	5 (42%)	7 (58%)
	2	Most well-rounded product	3			
	3	Open mind	2			
	4	Willingness	4			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Mistakes	1	Duplicates	9	26	8 (31%)	18 (69%)
	2	Prevention of duplicates	5			
	3	Proofread	4			
	4	Repetition	4			
	5	Sloppy	4			
On-task	1	Talking off task	15	21	10 (48%)	11 (52%)
	2	Workhorse	6			
Organization	1	Coordination	5	18	8 (44%)	10 (56%)
	2	Coordination: more needed	3			
	3	Planning	8			
	4	Systematic	2			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Participation	1	Absent for QP	2	9	2 (22%)	7 (78%)
	2	Exhausting	3			
	3	Will continue with course	4			
Practice	1	Booklets	4	12	6 (50%)	6 (50%)
	2	Preparation	5			
	3	Review FPSPI process	3			
Problem solving style	1	Application of VIEW training	3	10	9 (90%)	1 (10%)
	2	Understand differences now	7			
Quality	1	Better challenges needed	1	13	3 (23%)	10 (77%)
	2	Good challenges	5			
	3	Good ideas	2			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Quality	4	High standards	4			
	5	Speed sacrificed quality	1			
Relevance	1	Connections to Underlying Problem	4	6	4 (67%)	2 (33%)
	2	Justifying	2			
Research	1	Didn't do research	6	54	9 (17%)	45 (83%)
	2	Good research	3			
	3	More research needed	41			
	4	Need to research	4			
Schedule	1	Meeting outside of class before competition	3	10	4 (40%)	6 (60%)
	2	Scheduling conflict	7			
Scope	1	Broad/specific balance	4	10	3 (30%)	7 (70%)

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Scope	2	Too broad	4			
	3	Too narrow	2			
Self-knowledge	1	Kept quiet	2	18	15 (83%)	3 (17%)
	2	Know strengths	10			
	3	Know strengths and weaknesses	2			
	4	Know weaknesses	3			
	5	Quieter work environment	1			
Shared responsibility	1	Divided roles	68	88	41 (47%)	47 (53%)
	2	Encourage participation	15			
	3	Everyone knows how to do everything	5			
Steps	1	Developing criteria	4	123	46 (37%)	77 (63%)

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Steps	2	Evaluation skills	3			
	3	FPSPI process	33			
	4	Grid	3			
	5	Number	77			
	6	Scoring rules	3			
Strengths-based	1	Ability	6	42	25 (60%)	17 (40%)
	2	Know who is good at what	27			
	3	Meticulous	4			
	4	Strengths by steps	5			
Teamwork	1	Commitment needed	6	11	4 (36%)	7 (64%)
	2	Shared effort	2			

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Teamwork	3	Stress	3			
Time Management	1	Allocation of time	30	78	48 (62%)	30 (38%)
	2	Efficiency	11			
	3	Need stamina	1			
	4	Pacing	16			
	5	Task completion	14			
	6	Worried about the time	6			
Underlying Problem	1	Basis of success	12	23	12 (52%)	11 (48%)
	2	Identification	6			
	3	Make sense of problem	5			
Who benefits	1	All students	8	23	13 (57%)	10 (43%)

(continued)

Categories Generated from Codes

Category	Code Number	Code Name	Statements by Code	Statements by Category	Statements from Treatment Group	Statements from Comparison Group
Who benefits	2	All students if willing	2			
	3	Depends on type of student	9			
	4	Gifted students	1			
	5	New freshman	3			
Writing	1	Clear writing	9	33	16 (48%)	17 (52%)
	2	Elaboration	8			
	3	Lack of clarity	6			
	4	Poor elaboration	3			
	5	Wording	7			