EFFECTS OF THE SIX THINKING HATS METHOD ON CREATIVE PROBLEM SOLVING SHARED BY UNDERGRADUATE HONORS STUDENTS

by

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ABSTRACT

BENNA S. HAAS. Effects of the Six Thinking Hats Method on Creative Problem Solving Shared by Undergraduate Honors Students. (Under the direction of DR. CINDY GILSON)

Cultivating problem-solving in highly motivated university students remains a persistent priority in higher education. These highly motivated students often enroll in honors programs to engage in small group discussions with their like-minded peers to enhance creative problem-solving skills; however, limited empirical research exists on the effectiveness of creative thinking interventions on creative problem solving among introverted university honors students. This study focused on how the Six Thinking Hats (STH) method, a creative thinking tool designed to encourage individuals to think in parallel with those of others through six metaphoric Hats, increased creative problem-solving behavior in introverted honors students.

I used a quantitative, single-case multiple baseline design across four introverted university honors students was used to examine a functional relation between the STH method and creative problem solving. The dependent variables were: (a) total number of Hats, (b) number of topic-related participation units, (c) total number of creative ideas, and (d) total number of words per Hat. Results indicated a functional relation between the STH method and the number of Hats (i.e., perspectives), but no functional relation existed for topic-related participation units, creative ideas, and words per Hat. The social validity data, confirmed through thematic analysis, revealed three themes regarding the STH method: (a) awareness of metacognition, (b) meaningfulness of the intervention, and (c) application to problem-solving situations. This study offers a first step in contributing to the small body of experimental research on the effectiveness of the STH method in promoting multiple perspectives among introverted undergraduate honors students.

DEDICATION

I dedicate my dissertation to gifted students who took the road less traveled

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AAC&U	The Association of American Colleges and Universities
CPS	Creative Problem-Solving Model
IPIP	International Personality Item Pool Big Five Factor Marker
FFOE	Guilford's Fluency, Flexibility, Originality, and Elaboration
HEA	the Higher Education Act
HIP	High Impact Practices
NAGC	The National Association of Gifted Children
NCHC	the National Collegiate Honors Council
NDEA	National Defense Education Act
OECD	The Organization for Economic Co-operation and Development
PISA	The Programme for International Assessment
P2	The Partnership for 21st Century's Framework for 21st Century Learning

CHAPTER 1: INTRODUCTION

The purpose of this dissertation is to investigate the potential effect of a creative thinking tool to demonstrate participation in creative problem solving among introverted undergraduate honors students in a university. The study evaluated the effectiveness of the Six Thinking Hats method ([STH]; de Bono, 1999) in fostering creative problem solving in small groups among honors students. I used an experimental, single-case multiple baseline design across four participants in a classroom to determine if a functional relation existed between the intervention and the dependent variables. I also explored social validity of the intervention with a qualitative analysis of the participants' perspectives. In this chapter, I will provide a statement of the problem; an overview of federal, state, and local policies regarding gifted education at collegiate levels; and the need for a continuum of educational training to promote creative problem solving for university honors students.

Statement of the Problem

Cultivating problem-solving in high-achieving students remains a persistent priority within colleges and universities (Olszewski-Kubilius et al., 2016; Soulé & Warrick, 2015). This problem-solving skill is crucial, given the potential for high-achieving students to hold influential positions both nationally and globally (Bernstein et al., 2019). Particularly, these students not only contribute significantly to financial and economic advancements (Wai, 2014) but also engage in diverse perspectives, solve problems efficiently, and produce quality outcomes (Bernstein et al., 2019; Kaufman, 2016; Simonton, 2019). Additionally, creative problem solving requires complex thinking and collaboration, which is a specialized skill applied in specific areas of discipline and expertise. To date, limited studies exist regarding the effects of creative thinking interventions within college and university classrooms aimed at equipping

high-achieving students who are reluctant to participate in group settings, such as those who are introverted (Miller & Dumford, 2018). However, legislation for these students in higher education has existed for over 50 years, which further provides a rationale for studying the effects of a creative training method in a university classroom setting.

Federal Legislation

Following the critical event of Russia's launch of Sputnik in 1957, nurturing advanced adolescents and young adults in colleges and universities emerged as a national priority (National Defense Education Act [NDEA] of 1958; Jolly & Robins, 2022). The federal legislative landmark, the National Defense Education Act (NDEA), also stated that higher education must remove financial barriers and provide access to students on "critical subjects" (NDEA, 1958; p. 1102). Next, the Higher Education Act (HEA) of 1965, specified that advanced learners in postsecondary institutions, whether two-year or four-year institutions, are entitled to the same academic services as other subgroups, such as "students with disabilities, students who are limited English proficient, … and with low literacy levels" (HEA 1965, p. 91), which also had implications for teacher training. This legislation positioned advanced learners as an underrepresented group requiring specialized instruction to maximize their potential. Additionally, the legislation aligned the terms "gifted and talented students" (HEA 1965, p. 20) with those in elementary and secondary education, signaling the importance of a continuum of gifted education services from kindergarten to postsecondary levels. Unfortunately, the legislative discourse regarding gifted programming in higher education remains isolated from that of elementary and secondary gifted education programming (Colangelo, 2018).

Following the NDEA (1958) and the HEA (1965), the Marland Report (1972) defined and advocated for gifted and talented children and expedited federal support for elementary and

secondary gifted education. Although the Marland Report highlighted the urgency of implementing creative thinking instruction and training instructors for gifted and talented children throughout their younger development, it had little impact on instructional policies and practices for high-achieving college and university learners. Thus, both pieces of federal legislation underscored the instructional necessity of challenging and nurturing gifted learners from elementary to postsecondary levels.

Educational Contexts of Schools

Schools offer safe spaces and play a crucial role in offering creative training for introverted students. Schools lend themselves opportunities to engage the students to actively participate and share challenges and issues related to real-world problems and apply strategic approaches to problem-solve them (Renzulli, 2017; Sawyer, 2015). Additionally, creativity is an essential component for future generations to foster meaningful learning outcomes aligned with 21st century skills. Moreover, several national and global organizations have emphasized its measurement and monitoring in various policies for gifted and talented students. For example, the Programme for International Assessment (PISA), a study that measures students' cognitive and intellectual skills in mathematics, recently included a measure of creativity to inform policies regarding nurturing and developing advanced skills (The Organization for Economic Co-operation and Development [OECD], 2022). Similarly, the Partnership for 21st Century's Frameworks for 21st Century Learning stated that creative thinking is one of the essential learning and innovative themes that should be explicitly taught to K–16 students to prepare them for a complex work life and environment (BattelleforKids, n.d.).

Despite overwhelming empirical evidence on the importance of creative thinking in national and global leadership, more research has yet to explore the effects of creative thinking

instructional methods in undergraduate institutions to promote creative problem solving and prepare high-achieving young adults as leaders and collaborators. Further, creative thinking holds a central position in gifted education, especially in K–12 settings, transcending the boundaries of the arts and extending its value across various subject areas and domains, as reflected in federal education policies. Over the course of half a century since the first federal advocacy, state-level legislation for advanced learners in K–12 settings established creativity as one of the instructional methods in schools.

State Legislation

Although a substantial gap exists in understanding how creativity training can be effectively incorporated within undergraduate programs to nurture the creative potential of high-achieving students, the existence of the Marland Report strengthened state-level legislation for K–12 schools and school districts. For example, 32 states use definitions of giftedness that include creativity or creative thinking: Alabama, Alaska, Arkansas, Colorado, Connecticut, Delaware, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Minnesota, Mississippi, Nebraska, Nevada, New Mexico, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Utah, Vermont, Washington, and Wisconsin (Rinn et al., 2020). These definitions serve as essential support in promoting more inclusive and appropriate curricula and instruction for gifted and talented students, whether through general or specialized classes. Additionally states such as the following mandate differentiated services and require local school districts to develop educational plans for their implementation (Gilson et al., 2023), which include instructional strategies such as problem-based learning and creativity: the District of Columbia, Alabama, Arizona, Arkansas, Colorado, Indiana, Iowa, Kansas, Louisiana,

Maryland, Michigan, New Jersey, North Carolina, Oregon, Rhode Island, Virginia, West Virginia, and Wisconsin (Rinn et al., 2020).

Although gifted education policies have positively shaped and influenced states and local schools to cultivate and develop creative thinking in gifted and talented students, these federal, state, and local mandates fall short of serving gifted and talented students in postsecondary institutions. In the context of these limitations, many gifted and talented students select and attend honors programs, due to their academic challenges and course work that promote creative problem solving (Colangelo, 2018; Miller & Dumford, 2018). In that sense, honors programming is one of the few academic opportunities for gifted, talented, and high-achieving students to experience similar gifted education services as that of K–12 education. Ideally, higher education institutions provide convenient places where these students can safely engage in creative problem solving through practice, application, and academic discourse (Renzulli, 2017; Sawyer, 2015).

Undergraduate Honors Education

Unlike federal- and state-level legislation for a continuum of gifted education services, higher-level institutions developed localized "distinctive learning environments for selected students" (Definition of Honors Education, 2013, p. 1) based on their institutional and regional visions and goals. Honors education is highly localized, making navigating challenging unlike the case for many gifted education programs in K–12 school districts guided by the Gifted Programming Standards K–12 ([GPS], 2019). For example, Scott and Smith (2016) investigated the demographic landscape of honors education in higher education institutions and found that only 59% (n=1,503) of 2,550 postsecondary institutions offered honors education programs. The researchers manually searched their honors programs using "[a] search engine to locate website

information on honors education" and used "its internal search functions to see whether each institution offered honors education . . . [and] . . . relied on Google to identify if the institution delivered honors education" (p. 78). Difficulty navigating the honors program in institutions revealed a lack of uniform access for secondary students and families to understand honors programs based on student academic interests.

Honors education in higher education has proliferated since the 1920s across the United States (Rinn, 2006). What enabled the expansion of up to 400% growth in honors education (Scott et al., 2017) was not only institutional interest in increasing national ranking but also financial incentives among high-achieving or gifted young adults (Goodstein & Szarek, 2013). These high-achieving students, who often have plans for advanced degrees or transferring to competitive institutions, are qualified to apply for honors programs in institutions that offer grants, scholarships, and other types of monetary incentives to their honors program participants. Even though 1503 institutions offer specialized curricula in honors education carried out in programs and colleges (Cognard-Black et al., 2017), no matrices or standards exist to measure the effectiveness of honors curricula in four-year universities and colleges (Scott et al., 2017).

Honors programming principles from the National Collegiate Honors Council (NCHC) and High Impact Practices (HIP) recommended by the Association of American Colleges and Universities (AAC&U) guide instruction for honors courses in higher education. First, these principles include creative thinking as one of the learning outcomes. Undergraduate honors students must receive instruction that encourages "problem-solving . . . with creative approaches" (Definition of Honors, 2013; para. 5). The process of problem-solving is often situated in collaborative settings that require students to actively participate, engage, and respond to their peers and faculty's perspectives. As part of the principles of honors programs, NCHC has

focused on training faculty and honors administrators on the concept of experiential learning as an approach to developing curricula to help students solve ill-structured, real-world problems and work collaboratively to devise solutions that are original and authentic (Machonis, 2008).

Further, one of the HIPs specifically includes, "Collaborative Assignments and Projects" (AAC & U, 2024) that encourage honors students to increase their participation in dialogic discourse and learn from multiple perspectives shared by other peers; however, highly localized programming based on institutional characteristics prevent honors faculty from comparing or assessing student learning outcomes across institutions (Miller, 2018). A lack of more specific standards or guidance for honors curricula could be problematic because academically talented, who are likely to apply for honors education programs, come from elementary and secondary school experiences with gifted education programs in K–12 (Miller, 2018). Additionally, an absence of dialogic instruction can lead to boredom, underachievement, or even dropping out of undergraduate institutions (Ritchotte & Graefe, 2017), which can have long-term effects on introverted students who may like to internalize negative experience more than that of extroverted students (Skues et al., 2012; Yang et al, 2024). Misaligned curricula and instructional progression from K–12 settings into post-secondary schools could result in a loss of talent for advanced learners, which in turn could pose financial and economic challenges to higher education institutions (Assouline et al., 2015).

Promoting Creative Thinking in Undergraduate Honors Students

A continuum of gifted education programming in K–16 allows gifted and talented and high-achieving students to receive rigorous instructional services in higher education (Chancey & Butts, 2018). Undergraduate honors education, which encourage small class sizes, allows faculty and students to collaborate on real-life problems and provide a fertile ground to further

develop students' creative thinking. One of the frameworks to systematically foster creative thinking includes Osborne Parne's Creative Problem Solving Model (CPS; Isaken & Treffinger, 1985; Osborn 1979; Parnes, 1992), which encourages individuals to experience four cyclical phases: Clarify, Ideate, Develop, and Implement (Creative Education Foundation, [n.d]). This framework allows individuals to determine a topic or an issue and investigate ways to problem-solve throughout the stages (Treffinger, 2007). Another model is Guilford's Fluency, Flexibility, Originality, and Elaboration (FFOE), an opportunity to systematically engage students in creative thinking development (Guilford, 1962). Moreover, Fluency has shown to be an effective measure of creative thinking and optimizes honors students' experiences to generate potential solutions in small groups. A thinking tool, such as STH (de Bono, 1999), can be used in conjunction with training on creativity and creative problem solving, to minimize conflicts and invite all students to contribute equitably and efficiently to share their divergent ideas. More details about CPS, FFOE, and the STH model will be described later in Chapter 2.

Given that creative problem solving is promoted as a differentiated gifted pedagogical approach that promotes sophistication and intellectual engagement in group settings in K–12 (VanTassel-Baska & Brown, 2007; VanTassel-Baska & Hubbard, 2019), undergraduate honors students should also have opportunities to further develop their creative problem solving as part of extended gifted education services (Barbot et al., 2016; Rinn & Plucker, 2019). These gifted education opportunities also allow all students in honors programs, especially those introverted honors students, who might not have had opportunities to participate and lead small groups and actively engage in creative problem solving, to openly share their ideas with other honors students.

Research Purpose

The purpose of this study was to investigate to what extent introverted undergraduate honors students' creative problem solving and participation in small groups was increased in the classroom setting through the use of STH. In this study, I conducted a quantitative, experimental single-case research design–specifically a multiple baseline across four participants design–to evaluate the effects of STH (de Bono, 1999). I also conducted a thematic analysis of participant responses on their perspectives on the use of intervention within and outside of classrooms for social validity.

The participants were four honors students from one honors elective course who scored lowest on the extroversion factor on the International Personality Item Pool Big-Five Factor Marker (IPIP) survey (Goldberg, 1987). The independent variable was STH, and the features of the intervention were the Six Hats with different colors, where each Hat represented a specific way of thinking. The dependent variables were (a) the total number of Hats (out of six) counted as perspectives, (b) the total number of topic-related participation units, (c) the total number of creative ideas, and (d) the total number of topic-related words per Hat.

Significance and Contributions

The significance of this dissertation study is making a first step in conducting a behavioral intervention on creative problem solving for undergraduate honors students. This study could lead to conducting more experimental studies about increasing the effectiveness of an instructional strategy to support creative problem-solving and student participation in introverted honors students.

The first step was to discover causal relations between the intervention and the behavior of introverted honors students that may or may not justify the change in the behavior through a single-case design as a research methodology.

Secondly, experimental studies have posed challenges in gifted education because of the nature of the group designs in which gifted education interventions are withheld from treatment groups (Callahan et al., 2015). Further, the financial burden of recruiting researchers and data collection involves collaborating with school districts. Third, the flexibility to implement and evaluate multiple interventions with time-lagged interventions (Carr et al., 2014; Zettle, 2020) appeals to increasing rigor in gifted education research. To that end, a single-case design, one of which was used for this study, is widely used in special education as a quantitative experimental design to examine causal relations between the intervention and behavioral change (Ledford & Gast, 2018). What sets the single-case design apart from group design is that participants are their own comparison units by contrasting baseline to intervention scores related to the outcomes, which lead to high internal validity.

Fourth, recent advancements in a single-case design (Ledford & Gast, 2019; Ledford et al., 2022) provide timely opportunities to use the common language of *evidence-based practices* in gifted education (Thompson & Subotnik, 2010) through potential replications within four participants (Coyne et al., 2016). This pilot study is the first research in gifted education to examine functional relations between the intervention of the selected creative training method (i.e., de Bono's Six Thinking Hats) to increase creative problem solving and participation in gifted and talented students' dialogic discourse. In that sense, the research methodology of using the single-case design in gifted education will significantly contribute to a slim body of research on experimental interventions towards evidence-based interventions through replication studies

(Dai et al., 2011; Simonsen & Little 2011; What Works Clearinghouse, 2022). Additionally, this attempt to bridge the gap between K–16 in gifted education pedagogy and undergraduate honors can increase inclusive practices to reach highly motivated, academically advanced, and underachieving gifted students.

Lastly, the single-case design can increase opportunities to bridge the research-to-practice gap by allowing undergraduate instructors to easily access a teaching method with proven effectiveness and increase validity through research (Plucker & Callahan, 2019) for professional learning for university faculty. This study was a step in contributing to improving experimental research studies for gifted education, which is a high priority for the field.

Research Questions

The four primary research questions were:

1. To what extent will the STH method increase the total number of perspectives, counted by the number of Thinking Hats, shared by university honors students during small group discussion?
2. To what extent will the STH method increase the number of topic-related participation units shared by university honors students during small group discussion?
3. To what extent will the STH method increase the number of creative thinking ideas using Green Hat by university honors students during small group discussion?
4. To what extent will the STH method increase the number of topic-related words per Hat shared by university honors students during small group discussion?

In addition, the secondary research question is:

5. What are university honors students' perspectives on the use of the STH method within and outside of the honors classroom setting?

Delimitations

This study used a single-case multiple baseline design with four introverted undergraduate honors students. The participants were selected based on similar characteristic histories (Ledford & Gast, 2018) based on the demographic information and IPIP survey to increase the external validity. There are several delimitations for the study. First, one delimitation of the study is that the results from a single-case design cannot be generalized to a larger population of university honors students. Secondly, higher education does not commonly identify students for gifts and talents; therefore, the honors students selected to participate may or may not have identified as gifted and talented in their formative school years. Further, the participants are not representative of all academically talented in post-secondary institutions. Third, this study took place in an honors elective course in which honors students self-selected to take the creativity and creative problem-solving course. Since students self-selected the course, it is difficult to generalize results to other academically talented students who are not in an honors college program but did not select the creativity course. Finally, since I had a constrained timeline of one semester, I could not collect continuous data beyond 16 weeks.

Definition of Terms

The terms used in this study provide context for each section. Descriptions of each term are as follows.

Big Five Personality: The construct of the personality contains five dimensions: agreeableness; conscientiousness; neuroticism; extraversion; and openness to experience (Goldberg, 1993). Each personality dimension exists along a continuum that uses contrasting traits using the scales from low to high. For example, agreeableness ranges from trust and warmth to selfishness or distrust. People who are high in agreeableness tend to demonstrate kindness to others, whereas

individuals low in agreeableness are likely to be combative or caustic (Costa & McCrae, 1992). Someone with high conscientiousness can be described as thorough and dependable, and those with low conscientiousness as unreliable and inconsistent. Neuroticism is associated with nervousness and moodiness and contrasted with relaxation and calmness. While extraversion is equated with talkativeness, low extraversion can be associated with passivity or silence (Costa & McCrae, 1992). Openness to experience is associated with creativity and curiosity while a lack of it is related to having little to no perceptiveness or flexibility.

***Giftedness*:** This is a central concept in the dissertation that encompasses student potential or those who are identified as academically or intellectually advanced learners in general or specific areas (NAGC, n.d.). Giftedness is inclusive of diverse regional, cultural, ethnic, and socio-economic backgrounds. In undergraduate university settings, these learners are inclusive of high-achieving learners or students who meet the local criteria for honors programs (NCHC, n.d.). They are academically or intellectually advanced learners who have potential or are identified for gifted and talented programs based on local gifted education plans (Marland, 1972; Renzulli, 1978).

***Creativity*:** The construct is based on the idea of Guilford's Structure of Intelligence which allows learners to engage in original and novel ideas within an appropriate context (Runco & Jaeger, 2012).

***Creative Problem Solving*:** Developed by Osborn and Parnes (Osborn, 1953; Parnes & Noeller, 1972a; 1972b) and now taught by organizations such as the Creative Education Foundation, Creative Problem Solving is a framework comprised of four cyclical stages for producing solutions to real-world problems: Clarify, Ideate, Develop, and Implement. The framework uses

ongoing thinking tools such as divergent and convergent thinking skills to increase individuals' abilities to brainstorm, produce, and assess potential solutions to problems (CEF, n.d.).

***Dialogic Discourse*:** Unlike monologic discourse, dialogic discourse describes a pattern of talk or discussion between students and teachers or among students that assumes that a meaning-making process occurs through the sharing of multiple perspectives and interactions with others (Bakhtin, 1984).

***Gifted Education Programming Standards*:** The National Association for Gifted Children (NAGC, 2019) revised the seven standards for specific and measurable outcomes for gifted education practitioners and educators to appropriately use for curriculum instruction. The programming standards are also revised to guide researchers and other shareholders to conduct research and use them to evaluate and assess gifted education programs. For this study, the programming standards provide insight into how creativity or creative thinking is used to describe research-based interventions and outcomes for students (Corwith & Johnsen, 2019).

***Six Thinking Hats*:** Coined and developed by Edward de Bono, the method is a disciplined and structured way to engage individuals to think in a parallel direction represented by six different colors. The method has been used to generate ideas efficiently and effectively (de Bono, 1999).

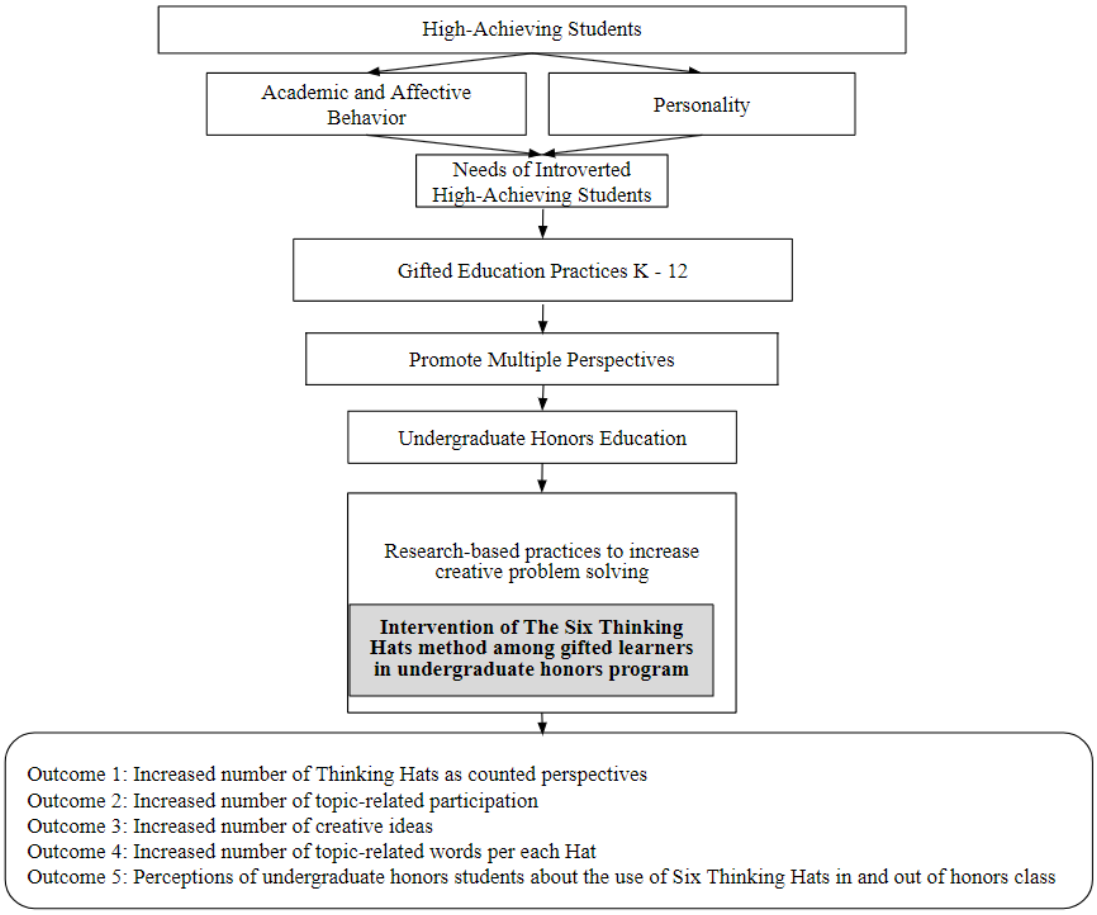
***Undergraduate Honors Education*:** An advanced program for academically motivated learners in four-year post-secondary institutions. These programs have criteria provided through applications, which include GPA, test scores, personal statements, and other measures to determine qualifications. Affiliated with the National Honors Collegiate Council, these honors programs emphasize independent projects, experiential learning, or creative thinking skills manifested through elective courses or additional credit hours related to interdisciplinary pursuits (Scott & Smith, 2016).

CHAPTER 2: REVIEW OF LITERATURE

This chapter includes a comprehensive review of the literature to provide background information and a rationale for the implementation of de Bono's Six Thinking Hats method in an experimental study. The overarching aim was to understand its effects on creative problem-solving among introverted honors students in a university context. In the first section, I discuss the existing literature on high-achieving students. Building on this foundation, the second section includes literature about gifted education pedagogy related to dialogic discourse. In the third section, I discuss undergraduate honors education as a context for promoting creative problem-solving. Lastly, the fourth section addresses the literature on creative thinking methods used in education and professional settings, primarily emphasizing the Six Thinking Hats method as the targeted intervention. To demonstrate the progression of the ideas above and outlined in this chapter, a visual representation of the conceptual framework is shown in Figure 1.

Figure 1

The Conceptual Framework



Conception of High Achievement

The exceptional achievements of individuals are universally acknowledged and celebrated throughout history (Hunsaker, 1995). These remarkable achievements often highlight their positive impacts on humanity through creative solutions, such as medical discoveries and innovative systems to elevate societal ills (Dai 2015; Renzulli, 2012; Simonton, 2020). Preference for weighing specific areas of achievements may vary depending on societal expectations, norms, and priorities; however, many empirical studies reveal that high achievement of individuals manifests through creative productivity, performances, and outcomes (Persson, 2020; Reis, 2021; Sternberg, 2007). In the context of this dissertation, the literature offers a comprehensive overview of high-achieving students and their relationship to creativity and creative thinking in educational settings.

Definition of High Achievement

Empirical studies across disciplines, such as psychology, education, and cognitive science, have consistently identified high achievement in individuals through qualitative and quantitative evidence, setting them apart from their typically achieving individuals (Csikszentmihalyi et al., 2018; Terman, 1925; Winne & Nesbit, 2010). Especially in school settings, high-achieving students possess strong academic achievement skills and a higher Grade Point Average (GPA). Additionally, many contemporary researchers believe that the construct between achievement and abilities are intertwined and difficult to separate them (Costa et al., 2018; Dai, 2023). Although definitions may vary, high-achieving individuals are often associated with motivation and creative endeavors (Cramond et al., 2021; Renzulli, 2016; Torrence, 1966; 1995). Additionally, high achievement is often associated with individual's beliefs in their capabilities, which affect their motivation, performance, and achievement (Bandura, 1997).

Moreover, creative endeavors also affect student motivation, performance, and achievement (Bandura, 1997; Cramond et al., 2021; Renzulli, 2016; Torrence, 1966; 1995)

The first historical landmark that formally established a need for schools to recognize and teach high-achieving students began with the first federal definition of giftedness, as stated in Marland's Report (1972. It encompassed six areas: (a) general intellectual ability, (b) specific academic aptitude, (c) creative or productive thinking, (d) leadership ability, (e) visual and performing arts, and (f) psychomotor ability. The report established the definition of giftedness in academic and intellectual areas and emphasized specific attributes, such as creativity and leadership. The National Association for Gifted Children (NAGC, n.d.) also has a similar definition; however, the NAGC Task Force (2019) updated the description to consider the contextual developments of students, including upbringing, culture, race, economic status, and learning disabilities, highlighting the comprehensive definition of giftedness.

Federal and national legislation delineated targeted definitions of giftedness related to student potential, abilities, and performances (Marland, 1972; NAGC, n.d.). Similarly, these gifted students exhibit academic or intellectual needs, such as seeking opportunities for an exceptional array of talents, abilities, and skills within and beyond the confines of formal educational environments (Lubinski & Benbow, 2021). Additionally, the manifestation of their giftedness or exceptionalities varies widely across academic and nonacademic domains due to their diverse experiences and exposures (Subotnik et al., 2018). Much of the available literature on gifted learners at the collegiate level centers around academic data sourced from higher education institutions, particularly emphasizing the context of undergraduate honors programs, where many high-achieving students enroll for academic rigor and career opportunities (Mamadov et al., 2018).

Academic Behavior

High-achieving undergraduate students demonstrate higher grades and Grade Point Average (GPA; Rinn & Plucker, 2019). First, researchers who have conducted empirical investigations on undergraduate honors students concluded a positive correlation between academic achievement and GPA in honors programs (Rinn & Plucker, 2019). Additionally, McClarty's (2015) analysis of the National Educational Longitudinal Study of 1988 data revealed that students who accelerated learning during early education years tend to gravitate towards challenging educational opportunities in college. The study underscored their extraordinary academic drive to acquire novel ideas and skills (McClarty, 2015). This further supports the meta-analysis from Gadja and colleagues (2017) about the positive correlation between creative measures and academic achievement measured by standardized tests.

Similarly, Spisak and Squires's (2016) two-part study revealed that high-achieving students thrive when presented with advanced academic courses in higher education. Study 1, conducted over two years with 786 high-achieving students, compared those who took no honors courses (control group) to students who took at least two honors courses (treatment group). The *t*-test results revealed statistically equivalent mean GPA. A follow-up Study 2 involving 450 students further demonstrated that honors students' GPA in their honors courses were statistically comparable to those in all their classes. The studies affirmed that challenging academic programs within honors programs for high-achieving undergraduate students would help them be successful (Spisak & Squires, 2016).

Moreover, the significance of college choice was often resolved around the rigor of coursework for gifted secondary students. Meyer et al. (2021) discovered in their qualitative thematic analysis that gifted learners' primary concerns for applying for college were based on

the rigor and challenge of the program and financial incentives. Further, these types of gifted learners were highly likely to matriculate to precollegiate programs in high schools, such as early college, dual degree programs, and other advanced learning opportunities in which students are exposed to college-level content but also pedagogical experiences such as seminars and self-paced programs, smaller faculty-to-student ratio, intensive research opportunities, and job shadowing (Colangelo, 2018). These unique academic or intellectual characteristics of high-achieving students are major aspects of academic or intellectual profiles across different majors in undergraduate institutions.

Social and Emotional Behavior

Social and emotional needs refer to noncognitive skills that contribute to achievement such as leadership, personality, interpersonal skills, and intrapersonal skills (Rinn, 2022). Particularly within gifted education, affective needs relate to the social and emotional development of undergraduate honors students, essential for nurturing their talents and facilitating collaboration within contextualized settings (Rinn, 2022). Undergraduate students have more specified interests in their majors and often require collaborating with others to problem-solve real-life issues that require nonacademic skills such as collaboration, leadership, empathy, and so on. Oftentimes, these types of soft skills are not explicitly taught, impacting students' other areas of need.

Personality

Personality has often been examined in relationship to creativity in the field of social science and psychology. One of the well-researched constructs is the Big Five Personality (Costa & McCrae, 1992; Goldberg, 1993; Rinn, 2022), which offers a research-based framework based on five dimensions of personality, including Agreeableness, Conscientiousness, Neuroticism,

Extraversion, and Openness to Experiences. Many studies indicated that Openness to Experience is correlated with creativity; however, researchers discovered mixed results about the correlation between introversion and creativity. Additionally, the concept of introversion was developed by Jung (1917) as an attitude of a person characterized by a focused interest in one's own "mental world" (Jeanes, 2019) and preference for solitude rather than expressing and sharing among the company of others.

Puryear and colleagues' (2017) systematic review of 188 articles discovered that the highest correlations on creativity were Openness to Experience and Extraversion. Further, Extraversion and divergent thinking were highly correlated. On the other hand, Ogurly and Ozbey's (2022) meta-analysis examined a significant difference between gifted and nongifted participants in terms of Openness to Experience; however, Extroversion was not a mediating factor. Further, Mammadov and colleagues (2024) investigated the relationship between personality types and psychological well-being of 483 undergraduate students. The dependent variables were life satisfaction, coping with stress, and psychological resilience. Particularly the undergraduate students' ability to cope with stress consisted of factors related to problem-solving skills, detachment, and accepting responsibility and self-critique. Using latent profile analysis, results indicated that introverted undergraduate students were at a greater risk of negative self-image and lack of coping skills on stress compared to extroverted students. This study indicated that introverted students are not likely to report problem-solving as their primary coping strategy compared to extroverted students.

Additionally, some research explored the relationship between personality traits and perfectionism. In a study by Cross and colleagues (2020), the authors discovered that honors students' personality profiles had perfectionistic tendencies, a personality trait that attempts to

attain perfection or setting unreasonably high standards for performance that results in critical views of oneself (Frost et al., 1990; Shaunessy et al., 2011). The sample was White/Caucasian (90.2%), which was like the university population. The participants were 109 males (26.6%) and 301 females (73.4%). Using Latent Profile Analysis, the authors discovered that two out of five personality profiles demonstrated introversion rather than extraversion. Each personality profile also had perfectionistic tendencies. The authors suggested that fostering a sense of community, keeping them interested through programs, and offering smaller peer mentoring platforms can enhance the match between personality profiles and the learning environment.

In sum, honors students' personality profiles and contextual variables provide complex learning profiles for higher education faculty to consider different ways to support introverted students in classrooms. As the research suggests, postsecondary honors students have academic or affective needs that can be met through rigorous learning opportunities and are likely to thrive in communities where they can maximize their gifts and talents. In that sense, the honors students who were recruited to participate in the study experienced how they could challenge themselves to verbally express their perspectives in a creativity class.

Underachievement

Having a discrepancy between a learner's potential and academic outcomes indicates underachievement (Reis & McCoach, 2000). This phenomenon can result in unintended consequences, such as dropping out of programs, losing interest, and lacking engagement, often impacting the decision to apply for selective undergraduate programs, such as honors (Steenbergen-Hu, 2020). Despite limited empirical data on underachieving learners within postsecondary settings, insights into the characteristics of these gifted learners have the potential to inform honors faculty about how to tailor instruction to maximize potential.

Additionally, underachievement is closely related to self-belief and motivation. Fong and colleagues (2019) conducted a study exploring math motivation through a longitudinal study from Grade 9 to college. The authors used a generalized structural equation model to understand the predictors of underachievement among college students. The results indicated that students' beliefs about mathematics were central to their identities and indirectly affected college outcomes. This study revealed that interventions targeting opportunities to help gifted learners find value and interests will increase the likelihood of reversing underachievement.

Further, underachievement intersects with academic or intellectual needs where honors students find meaningfulness in academic or intellectual challenges. First, Plominski and Burns (2018) observed that honors program participation among gifted learners was associated with meaningfulness in academic achievement. The authors compared honors undergraduate students (n = 641) with non-honors students (n = 386) whose mean ages were about 21 and concluded that honors students have specific affective needs. The measures used to assess affective needs were selected from indices from higher education regarding psychological well-being: The *t*-test results indicated that honors students have a higher level of positive well-being and self-concept than non-honors students. The factors that influence their psychological well-being are attributed to honors students' autonomy provided by honors programming that has smaller class sizes, student-led projects, and higher academic grades compared to that of typical programs.

Moreover, collaborative opportunities with like-ability peers emerge as a significant source of success for gifted adolescents (Cross & Swiatek, 2009; Foubister, 2017). This significance of peer relationships becomes evident as gifted learners seek connections with peers who share their ideas and experiences. High-achieving students not only find meaningfulness and fulfillment from academic challenges but also benefit from connecting with other like-

minded peers (Goings & Ford, 2018). Although research on high-achieving college learners on like-ability peers is limited, Hodges and colleagues' (2022) study revealed how gifted teenagers connect with other gifted peers. For example, the researchers used Reddit as the data source to analyze sentiments about giftedness regarding self and others. One of the results indicated that gifted teens had more negative word counts related to giftedness. It could be inferred that they preferred to connect with other gifted peers to discuss sensitive topics regarding giftedness. To that end, effective interventions to support this population could benefit undergraduates to exchange and share their perspectives about real-life problems (Dai & Chen, 2013; Plucker & Callahan, 2019). These empirical studies demonstrate that peer relations among advanced youths and emerging adults are important to making a step toward solving problems in school contexts.

Gifted Education Pedagogy in K – 12

Research related to high-achieving academic and affective characteristics is similar to the needs of undergraduate honors students discussed above. Additionally, research on providing differentiated instruction to meet their academic and affective needs has dominated the field for the past century (Callahan et al., 2015; Van Tassel-Baska, 2017). As a result, research has guided K−12 practitioners to apply research-based models and methods to cultivate students' gifts and talents (Hockett & Doubet, 2020; Ziernward et al., 2022). Additionally, NAGC Gifted Programming Standards K–12 (2019) emphasized evidence-based practices that promote growth in creative thinking, which is targeted to produce academic and affective outcomes appropriate for gifted learners (Cortwith & Johnen, 2019). The term creative thinking in GPS highlighted it as both a thinking process and learning outcome and explicitly mentioned it more than ten times throughout the standards.

Creativity

Despite varying constructs of creativity, researchers agreed that creativity must be original, functional, and appropriate (Kaufman & Sternberg, 2010; Runco & Jaeger, 2012). Often applied across subjects and domains, creativity, an attribute that can be developed through acquisition and training (Osborn, 1963), means the process of solving real-world problems (Attanasi et al., 2021; Basadur et al., 2014). For example, Osborn (1966) suggested that creativity could be nurtured and fostered through practice and leisure activities. He believed that stimulating one's cognitive domains, such as "playing puzzles, hobbies, fine arts, reading, and writing" can contribute to individuals' ability to problem solve and think creatively (pp. 69-85), which provided a framework for gifted education training for instructors.

Another creativity framework introduced by Kaufman and Beghetto (2009), the Four C, applies to all individuals. Most investigations of creativity tend to take one of two directions: everyday creativity "also called little-c," which can be found in nearly all people, and eminent creativity "also called Big-C," which is reserved for prominence (p. 61). Specifically, Kaufman and Beghetto extended the idea of mini-c, creativity inherent in the learning process, and Pro-c, the developmental and effortful progression beyond little-c that represents professional-level expertise in any creative area. This dissertation frames creativity through the interactive lens of mini-c and little-c in which undergraduate honors students are provided an intervention to increase their ability to engage, interact, and produce potential solutions to real-world scenarios.

Guilford (1968) delineated how creativity could be measured through the Fluency, Flexibility, Originality, and Elaboration (FFOE) model, which is part of the Structure of Intellect theory. Fluency means generating many ideas, where individuals generate different and creative ideas. Flexibility represents changes in the direction of thinking and types or categories of

responses related to each other. Originality indicates producing the most unusual ideas; whereas Elaboration involves producing well-elaborated ideas and/or the detailed steps needed to make the plan work (Guilford, 1968). In particular, researchers have widely used fluency to measure creative thinking (Runco & Acar, 2012) and this informed how the Green Hat in the STH method (further described below) could be quantified and measured in this study.

Creative Thinking

Thinking and learning behavior can be developed through research-based practices (Lamb, 2020). Accordingly, creative behavior helps develop opportunities to increase productivity and engagement. Despite limited studies on how higher education institutions promote creative thinking in classrooms, researchers have conducted empirical studies to advocate for increasing creative thinking in university and college students.

In a pilot study that included 104 university students, Karunarathne and Calma (2024) used a mixed-method approach to measure the extent to which university students could produce products that reflect their creative thinking. The researchers provided an open-ended task for students to apply their creative thinking skills and produce a draft, and then after receiving feedback, submit a final product. The instrument used to measure the participants' creative thinking was the markers adapted from the framework of the Programme for International Student Assessment (PISA, n.d.). The authors measured creative thinking dimensions (e.g., generate diverse ideas and generate creative ideas) and creative thinking domains (i.e., visual expression; scientific problem-solving; written expression; and social problem-solving). Result demonstrated that the creative thinking dimensions and domains increased through verbal and written feedback. This pilot study revealed that instructors' feedback contributed to university students' creative thinking.

Divergent Thinking

Divergent thinking, the ability to generate many different ideas and solutions to an open-ended problem (Kaufman, 2016; Runco, 1999), promotes creative thinking. As a specific creative behavior often used to measure a number of ideas, it allows learners to think of potential associations or ideas in large quantity. Often, divergent thinking involves researchers measuring the extent to which an individual can come up with different ideas as part of the creative process. According to Batley and colleagues, 83 undergraduate students participated in a study in which they used Guilford's Unusual Uses test as an instrument to measure their fluency (2009). The four assessments used to measure the relationship between intelligence, personality traits, and divergent thinking were: Unusual Uses Tasks, Wonderlin Personnel Test, Baddeley Reasoning Test, and Big Five Personality Test. Results indicated that little to no relationship existed between intelligence and personality; however, a positive correlation between extroversion and divergent thinking indicated that personality affected creative thinking. The authors also conducted a multiple regression analysis to see which factors would predict divergent thinking and discovered that extroversion and intelligence systematically predict divergent thinking. The study's implication suggested that instructors can teach divergent thinking to improve students' ability for creative thinking.

In a quasi-experimental study, Lee and Therriault (2013) observed the effects of working memory and intelligence on divergent thinking. In a laboratory setting, 265 undergraduate student participants were given associative and categorical tasks. First, students made a list of all the words that started with the letter 'f' for 2 min. After completing the task, students created a list of as many types of animals and jobs for the next 2 min. Lastly, they took the Abbreviated Torrance Test for Adults. The result indicated that associative fluency was the strongest predictor

of divergent thinking. This finding indicated the importance of creative thinking training among undergraduate students because fluency is also feasible to count based on the participants' verbal outputs during problem-solving process in small groups.

Convergent Thinking

Creative problem solving also uses convergent thinking, a creative thinking process that evaluates potential solutions and selects the best answer (Guilford, 1975) to solve problems. The benefits of convergent thinking are that it allows individuals to make selections from various options (Cropley, 2006; Tan 2015). Convergent thinking is mainly assessed to provide insight to problem solving and validate findings. According to Wu's (2020) systematic review, convergent thinking was often used in studies related to maintaining memory, attention, adaptivity, and intuition. According to Zhu and colleagues' (2019) systematic review of the use of the Scholastic Aptitude Test (SAT) on creativity, convergent thinking research has been most prevalent in understanding the creative process and providing insight into the problem-solving process. Findings indicated that divergent thinking and convergent thinking both played a role in scientific creativity. Adaptability in creative problem solving is an important attribute in group thinking and engagement.

Creative Problem Solving

Creative problem solving is a framework loosely defined and embedded into gifted education pedagogy and written in as part of differentiated education plans in school districts across secondary schools, including North Carolina (Gilson et al., 2023). Interchangeably used as a concept, instructional method, or curriculum, creative problem solving offers a wide range for students to use specific techniques to pursue their interests and interdisciplinary topics. On the other hand, the *Creative Problem Solving (CPS)* framework is a specific process (Creative

Education Foundation, n.d.) that uses divergent and convergent thinking skills to solve real-life problems through four multiple, iterative stages (Parnes & Noller, 1972a). The CPS is an educational framework designed to challenge students to arrive at solutions to real-life problems (Treffinger, 2007). Founded by Osborn and further developed by Parnes and Noller (Creative Educational Foundation, n.d.; Treffinger & Isaksen, 2005), CPS used in classes empowers students to develop abilities and skills to face challenges and become independent thinkers. According to Guilford (1975): " . . . divergent and convergent production are not complete opposites. The significant difference is that in divergent production, the situation is open. . . . In convergent production, the given information is so restrictive that only one response is fully acceptable" (p. 168).

To promote advanced students' problem-solving abilities in undergraduate honors students, Parnes and Noller (1972b) conducted a two-year project to demonstrate the effectiveness of creative problem-solving techniques. Their research demonstrated the value of creative training programs to foster innovation and creative thinking abilities among students. The four stages of cyclical steps are: Clarify, Ideate, Develop, and Implement, allowing individuals, or groups to collaborate, to find solutions for their inquiries or problems. Further, CPS process requires problem solving to take place in collaboration with others to discuss ideas.

Dialogic Discourse

Similar to creative thinking, which is an explicit skill that can be taught in classrooms through models of inquiry, dialogic discourse is a form of communication in which the skill can be taught through an exchange of thoughts and ideas with others about texts, problems, or issues (Bakhtin, 1981; Knuth & Peressini, 2001) and allows students to generate divergent ideas as a group. The process allows students to deepen and diversify perspectives and is often

recommended to be used as a differentiated instructional practice to increase rigor in thinking skills among gifted learners in school settings (Gilson et al., 2023; NAGC Gifted Programming, 2019).

Moreover, dialogic discourse has been integrated within different methods and strategies as interventions to help students obtain creative and problem-solving skills. Studies have shown that dialogic discourse creates academic environments for students to produce original ideas. In a qualitative study, Netz (2014) conducted a discourse analysis of 22 gifted adolescents and seven teachers in which the 15-hr transcript analysis supported the idea that advanced and gifted students were engaged in stimulated conversation when teachers provided opportunities for students to initiate and generate ideas instead of teacher provided prompts. The study highlights the patterns and structures of language used in communication and enables the researcher to gain insight into the complex thinking skills of gifted students.

Further, gifted students become engaged when complex ideas are presented and are likely to share more ideas with others. Willard-Holt et al. (2013) discovered that advanced students with exceptionalities prefer to learn best when they can delve deeper into ideas for themselves. In a mixed-method study in which 16 twice-exceptional students' grades ranging from Grade 5 to college students participated in a survey with a follow-up interview, Willard-Holt and colleagues identified that "complex ideas and ways to think about them" (p. 152) was one of the most preferred strategies that worked best for twice-exceptional students. In addition, the study revealed that twice-exceptional students felt challenged when they were provided opportunities to think differently about a problem or issue. Additionally, one of the characteristics of academically advanced students is the likelihood of producing more advanced or rare vocabulary during conversation than typically developed children. The more students are exposed to dialogic

discourse the more they are likely to take multiple perspectives that can lead to innovative and creative solutions to problems. The STH method was chosen for this dissertation research because it facilitates students to exchange thoughts to generate and construct ideas and meanings.

Listening Orientations

Listening is an integral aspect of dialogic techniques for gifted learners to take multiple perspectives (Shaunessy, 2000). The types of listening and questioning behaviors in dialogic discourse exchanges are those that solicit richer responses that require students to interpret, analyze, or argue against or for statements in the text.

Many studies have evidence to support how listening and questioning techniques increase students' critical thinking skills. Ritchotte and Zaghlawan (2019) found that coaching parents to use a higher-level questioning strategy can increase twice-exceptional gifted children's oral expressions. Using Revised Bloom's Taxonomy as a guide, the authors juxtaposed lower-level and higher-order categories to provide training for parents. Some sample question stems include "What is the relationship between … and …?" and "How would you solve … using what you have learned?" (p. 92). Researchers used a single-case, multiple probe design across participants' designs to examine the parents' ability to learn and implement the higher-level questioning strategy and the effects of the parents-delivered questioning strategy on the complexity of their children's expressive language. In the same way, this dissertation study used a single-case research design to investigate honor students' participation and creative thinking.

In a different study related to listening and questioning techniques, Murphy and colleagues (2021) used prescribed initial and follow-up questioning techniques for elementary school students to demonstrate complex reading and thinking skills by asking questions to each other in small groups. The teachers modeled specific questions that required students to use

evidence to support ideas and make connections to real life. Then, teachers used follow-up prompts to help students think critically about the topic, such as asking students whether they could explain why they thought that way or what evidence could they use to support their ideas. The results of this study indicated that students who were engaged in quality talk improved their reading comprehension skills and demonstrated critical and analytical thinking skills.

Lastly, Nippold and colleagues (2017) examined spoken language production in young adults whose ages were from 18 to 20 and investigated syntactic complexity by asking critical questions about the text. Researchers analyzed 20 young adults' spontaneous speech samples for their use of complex syntax structures. The results showed that the participants produced syntactically complex sentences at a higher rate when critical questions, such as questions that are interpretive or analytical, were asked about the text than were previously reported in the literature in which questions about their daily lives were asked. The study suggests that appropriate questioning about texts provides valuable information about language production in young adults.

Both listening and questioning techniques in dialogic discourse elicit different perspectives. Attentive listening and higher-level questioning techniques are important for gifted learners to understand and reflect on specific aspects of problems or situations and engage in meaningful conversation. Dialogic discourse refers to a student-centered approach to having conversations for open-ended and divergent prompting and ongoing dialogue (Gilson & Little, 2016). Dialogic discourse requires active listening and speaking with each other to share their ideas and values. Dialogic discourse is one of the important elements for gifted learners because they can gain the perspectives of others.

Gifted learners perceive that dialogic discourse is an effective tool to foster a sense of belonging. Gilson and Sauder (2023) conducted a study with gifted readers in an elementary school assigned to 5 groups. They conducted a thematic analysis of how gifted readers perceive teacher listening and discovered that listening is a specific behavior that allows students to be engaged in follow-ups and led to new ideas. Unlike monologic discourse, dialogic discourse allows advanced learners to ask follow-up questions and demonstrate higher-order thinking and questioning with their peers and teachers (Gilson & Sauder, 2023). As students are engaged in discourse, they share different ideas, deepening each other's perspectives and values. This practice is connected to the honors program as it was first introduced to college students at Swarthmore College in the 1950s to engage advanced learners (Rinn, 2016). Further, dialogic discourse creates a context for advanced learners to interact with each other to collaborate and devise various solutions for creative problem solving. One of the important elements in dialogic discourse is solving problems through collaboration (Osborn, 1963).

Loes et al. (2017) conducted a study to examine whether collaborative learning affected persistence among college students. The participants were the 2,987 freshmen across 19 higher education institutions. After controlling for confounding factors (i.e., sex, race, pre-college academic ability, academic motivation, courses, and the types of institution), those students who engaged in collaborative learning were significantly more likely than students who did not learn collaboratively to sustain through the 2nd year of college. The study suggests that collaborative learning helps college students have a positive outlook on college and is likely to stay for the following school year. Lastly, the study also discovered that persistence seemed to be mediated by peer interactions. In other words, learning collaboratively leads to greater levels of positive

peer interactions, which in turn is associated with greater odds of persisting to the 2nd year of college.

In sum, dialogic discourse allows advanced and gifted students to engage in purposeful listening, speaking, and thinking through multiple lenses in small group settings (Gilson & Little, 2016; Gilson & Sauder, 2021). Promising interventions that promote dialogic discourse in K–12 settings include: Socratic seminars; shared reading; book clubs accompanied by higher level texts and questioning techniques (Gilson et al., 2023; Little, 2012; Shaunessy, 2000; Van Tassel-Baska, 2021). Moreover, these students, who are identified in elementary and secondary school years for gifted programs, typically apply for university honors programs based on their academic rigor and interests. Many factors, such as local and regional resources, parent expectations, and other variables may have an effect; however, research demonstrates that undergraduate honors programs positively influence the development of advanced and gifted students (Rinn & Plucker, 2019). These students might have had early entry to kindergarten, grade-level acceleration, enrichment opportunities, or other types of gifted education programs in elementary and secondary schools (Gilson et al., 2023). This dissertation recruited these students with similar characteristics to examine the effects of STH on collaborative and creative problem-solving skills.

Undergraduate Honors Education

Undergraduate honors education, although historically distinct from gifted education, aligns with shared values, attracting academically advanced learners driven by their career and professional aspirations. Characterized as “the academic unit on a collegiate campus responsible for devising and delivering in-class and extracurricular academic experiences that provide a distinctive learning environment for selected students” (NCHC, 2013, p. 2), undergraduate

honors education employs an interdisciplinary cohort model to meet the needs of high-achieving students. Just like the gifted education identification process, these programs use localized selection criteria based on regional and institutional characteristics. For example, some honors programs use high school GPA, standardized test scores, academic transcripts, and/or learning profiles to determine appropriate programming sections for students (Siegfried, 2001). By examining a brief history of undergraduate honors education, its principles and practices, and its role in promoting creative thinking, this literature review section provides insight into its relevance for promoting creative training methods for gifted learners.

History

Differentiated pathways for high-achieving undergraduates can be traced to earlier forms of honors education promoted through advanced examinations leading to honors status at Oxford University (Jolly, 2020; Rinn & Plucker, 2019). This practice evolved into initiatives like the Rhodes Scholarship, fostering academic and athletic exchange programs at Oxford University. Additionally, when the Rhodes Scholars from Swarthmore returned to the United States, they brought with them open-ended, dialogic learning methods to campus (Rinn, 2006). The subsequent establishment of the National Honors Collegiate Council, spearheaded by Joseph Cohen, standardized and enhanced honors programs in universities across the United States (Rinn, 2007). Furthermore, the current state of honors programs has undergone some shifts to be inclusive of diverse perspectives by publishing guiding principles for universities to consider when supporting advanced undergraduate learners.

Characteristics of Undergraduate Honors Programs

Undergraduate honors education adapted its instructional framework from the eleven High Impact Practices (HIPs) introduced by AAC&U (2023), although the website does not fully

elaborate its research studies to justify the practices: (a) Capstone Courses and Projects, (b) Collaborative Assignments and Projects, (c) Common Intellectual Experiences, (d) Diversity/Global Learning, (e) ePortfolios, (f) First-Year Seminars and Experiences, (g) Internships, (h) Learning Communities, (i) Service Learning, and Community-Based Learning, (j) Undergraduate Research, and (k) Writing-Intensive Courses. Some research studies conclude that several practices have demonstrated their efficacy.

A research study involving 4,193 full-time first-year undergraduate participants at 17 colleges and universities across 11 states explored the effectiveness of HIPs, particularly *Collaborative Assignments and Projects* and *Undergraduate Research* (Kilgo et al., 2015). Using ordinary least squares (OLS) regression, the authors examined the students' levels of academic and intellectual skills using questionnaire instruments regarding students' college experiences, the National Survey of Student Engagement, and the Student Experiences Survey. Despite its limited sample size in which many of the participants attended liberal arts institutions, the research revealed valuable insights into the effectiveness of high-impact practices supporting some of the assertions by AAC&U.

As mentioned in the HIPs, undergraduate honors programs value participatory learning with selected peers and faculty. Additionally, academic engagement and interdisciplinary approaches characterize the undergraduate honors program. Undergraduate honors students seek challenging courses that are highly engaging. Based on the work by Miller and Dumford (2018), in which they conducted 20 hierarchical linear models (HLMs) on six of the ten engagement indicators as dependent variables, there were strong, positive outcomes on reflective and integrative learning for freshmen honors students and faculty interactions for senior honors students.

Similarly, Miller and Siberstein (2018) discovered that collaborative relationships among peers and faculty are important. They conducted another study using the Faculty Survey of Student Engagement (FSSE) and compared two groups of faculty: honors and non-honors. Along with core FSSE items, this study used responses from 1,487 faculty members at 15 institutions on two experimental items about teaching honors courses. Based on the OLS regression analyses, honors faculty who teach honors students are more engaging in the areas of student-faculty interaction, learning strategies, and collaborative learning than of non-honors faculty. Additional analyses for high-impact practices also suggested that faculty who teach honors courses are more likely to work with undergraduates on research and to think that it is important for students to participate in learning communities, study abroad, and research with faculty.

In a longitudinal retrospective study conducted by Perrone et al. (2010), 88 adults were surveyed through school counselors in high schools to participate in a qualitative study in which the median age range was from 35 to 37. Of the ten themes, the gifted adults recollected problem-solving skills they learned in honors class, peer interactions, and small class sizes that provided personalized attention from faculty. These themes reflected to what extent the gifted adults felt about the rigor of the honors classroom regarding challenge and creative thinking.

Gifted Learners in Undergraduate Honors Programs

Postsecondary transitions pose unique challenges such as independence, career decisions, and societal expectations (Jung, 2018; Worrell, 2015). Those challenges include selecting higher education institutions and majors or deciding what vocational paths in which they are highly contextual, open-ended, and complex. They must learn how to navigate collaboration and problems necessitating a comprehensive exploration into the effectiveness of creative training interventions to increase collaboration and real-world efficacy. Despite inconsistent

identification processes for gifted services in K–12 (Matthews & Rhodes, 2020), gifted learners in elementary and secondary education systems receive a dosage of differentiated instruction and programming options based on local gifted education mandates. Due to the paucity of research on gifted learners' creative problem-solving skills in postsecondary institutions, the first section underscores academic and affective characteristics known in the context of K–12 and builds on research studies on undergraduate honors programs, where gifted learners who have received K–12 gifted services tend to enroll (Rinn & Plucker, 2020).

As previously stated, gifted learners in undergraduate honors programs might have received advanced programming options in elementary, middle, or high school programming options. Some gifted learners, by default, might be enrolled in honors programs if they chose to attend postsecondary institutions that were less selective. With diversified and varied levels of educational backgrounds, depending on the local selection process, honors programs also have other high-achieving or highly motivated students to enroll in the program. Furthermore, some self-nominate or automatically matriculate to honors programs that are generally interdisciplinary, individualized, or research-intensive (Rinn & Plucker, 2020; Scott et al., 2017).

Additionally, honors programs also have high-achieving learners, a group of diverse, self-motivated and committed learners, although they might not have been identified or served in gifted programs in their formative school years. These highly motivated students often demonstrate an interest in their respective fields of discipline earlier in their undergraduate programs and excel in specific academic areas; however, despite the students' high motivation, commitment, and interests, little is known about to what extent university honors programs provide instruction that is differentiated based on their academic or intellectual strengths, gifts, and talents to equip them for competitive career opportunities or advanced degrees.

One of the characteristics of gifted learners in honors programs is their relationship with influential adults, particularly teachers. Siegle and colleagues (2014) conducted a qualitative study with 28 university honors freshmen and discovered that their motivation to do well had to do with their interaction with high school teachers. This study revealed that teachers' role in developing and maintaining motivation was critical to them. Since teachers with extensive depth and breadth of content knowledge are better able to foster student motivation, the article revealed that gifted undergraduate students do better when there is flexibility and communication with their teachers who are trained and equipped to understand gifted undergraduate students.

Another study by Ridgley and colleagues (2022) also revealed some of the characteristics of honors college students whose ages ranged from 18 to 22. During stage 1, the researchers determined what would be challenging for each honors student by having them take seven Graduate Examination (GRE) Record questions with varying difficulty levels. Then, each student’s data were analyzed to select one easy and a difficult question. After completing the seven questions, they were asked to complete a short Likert-style survey to determine difficulty of the questions. The researchers explored the differences between the forethought phase and self-reflection phase processes, in which results indicated that gifted students had lower self-efficacy when approaching challenging tasks. On the other hand, gifted students did not have a greater interest in challenging themselves to solve complex problems. Students may have learned to strategically approach when completing easier tasks but lacked experience with difficult tasks where they were to transfer the strategies they learned through easier tasks. Lastly, gifted students provided lower scores on their self-evaluation survey and reported that they had to put higher effort on challenging tasks (Ridgley et al., 2022). According to Calbrese and Capraro (2021), the attitudes of gifted high school students at an honors STEM summer camp were

compared to that of adults when engaged in self-directed learning. The exploratory factor analysis, five *t*-tests, and the effect sizes demonstrated that after engaging in a self-directed learning experience, students expressed more confidence and motivation while having less anxiety. They were also less task-completion oriented. The study implied that gifted and honors students may have a tendency to learn like that of adults rather than their peers in schools.

Further, the connection between honors education and gifted education is that there are common themes. The program and services: (a) go beyond the minimum in achievement, (b) enroll through some type of criteria, and (c) promote common experiences of diverse students across majors and interests (Colangelo, 2018).

Creative Thinking

Creative thinking is an important aspect of undergraduate curricula, especially in honors programs because it is highly interdisciplinary in nature. According to Miller's (2018) quasi-experimental study, student engagement was evaluated on an annual survey from first year and senior students at four-year colleges and universities across the United States to assess student exposure to and participation in effective educational practices. The independent variables were taken from the Senior Transitions Module, which asked students to what extent the course work addressed the following: 1) generating new ideas or brainstorming, 2) taking risks in your coursework without fear of penalty, 3) evaluating multiple approaches to a problem, and 4) inventing new methods to arrive at unconventional solutions (Miller, 2018). The dependent variables were the 10-scale Engagement Indicators from the NSSE. Using regression models to analyze the data, the author concluded that there was a strong and positive correlation among all ten subsets of variables of engagement and creative courses.

Gajda and Beghetto's (2017) meta-analysis of 120 studies that examined the relationship between creativity and academic achievement since the 1960s revealed that the relationship between the two was stronger when creativity was measured using creativity tests compared to self-report measures. Creativity tests have substantive empirical evidence for the following areas: divergent and convergent thinking. This verifies that creativity assessments are valid and can have far-reaching effects on learning (Gajda & Beghetto, 2017).

The qualitative nature of measuring the effectiveness of the honors programs makes it difficult to assess its outcomes (Driscoll, 2011). At the same time, the honors program's instructional curriculum priority is to foster student development or transformation in some or all the following measurable outcomes: "problem-solving, often with creative approaches; critical reading; clear, persuasive writing; oral presentation; critical thinking; forming judgments based on evidence; artistic literacy; articulated metacognition; and spiritual growth" (NCHC, 2013, p.1).

Self-directedness is one of the characteristics of honors programs that gifted undergraduate learners value in academic programs. After evaluating the World Value Survey of 82,992 participants from 57 countries, Chiu and colleagues (2015) discovered that there is a positive relationship between the level of participants' educational attainment and creative engagement at work. Further, the main effects of value toward creativity and autonomy at work were positive and significant. Also, their effect on creativity and autonomy at work was strengthened by the socialization focus on self-directedness based on national culture.

Practices for advanced youths have been supported in at least 20 different universities and have become common programs to support advanced students in local districts (VanTassel-Baska, 2018) as pre-collegiate courses. These advanced programming options offered by local

universities prepare advanced learners to prepare for rigorous programs as undergraduate advanced learners. These students, who graduate from different advanced programming options (Rinn et al., 2021) such as early college, dual-enrollment programs, honors, or other programs offered to students with gifts and talents in K–12 settings, are likely to apply for honors programs as undergraduates (Chancey & Butts, 2018; Rinn et al., 2021).

A research study conducted by Miller and Dumford (2017) indicated that undergraduate honors students benefit from Renzulli's Type III enrichment framework, which is exploratory and interdisciplinary. The data source for the study was the National Survey of Student Engagement (NSSE, 2015), in which the dependent variables were Engagement Indicators. The core curriculum for freshmen honors students exposed them to enrichment and interdisciplinary exposures. For seniors, capstone or thesis writing courses exposed them to faculty interactions compared to that of general education college students.

Gifted learners in undergraduate honors programs learn with those of others from rural, urban, and multi-lingual backgrounds and come with varied levels of exposure to creative thinking that require teachers to differentiate instruction. Often, these underrepresented students' ability to express and engage in creative thinking can be inhibited due to their background experiences. These students may have different creative processes and differently normed collaboration skills based on their backgrounds and upbringing. For instance, Asian (48.1 percent) and White (47.7 percent) students in two-year institution were much more likely to transfer to a four-year institution than Black (28.4 percent) and Hispanic (37.2 percent) students. These findings reveal that Asian and White students are more likely to supplement their four-year coursework at a two-year institution and continue their academic pathways at a four-year institution than other marginalized students (National Student Clearinghouse, Transfer &

Mobility, 2018). To that end, state policies should have a localized commitment to promote independence, leadership, and academic excellence among diverse learners (Paik et al., 2018; Matthews, 2004).

The longitudinal studies conducted by the National Center for Education Statistics ([NCES], 2023) in which high school students' data were analyzed in 2009 and then again in 2016, predicted that postsecondary enrollment of youths from rural areas will increase by 6% within the next decade. Increased enrollment of rural undergraduate students and diversified populations (NCES, 2023) call for meaningful and effective curriculum and instructional strategies that are differentiated, enriched, and accelerated to support their gifts and talents and prepare them to develop their creative problem solving and self-efficacy.

Based on the shared principles of instruction, the NCHC (n.d.) stated that curriculum requirements include preprofessional and professional training requirements, choices that can help them persevere through the program, and other co-curricular skills such as leadership training and civic engagement. The tenets of instructional guidelines as represented as Honors Education Principles and Practices (n.d.) provide the framework for honors students and can be compared to that of GPS (see Table 1)

Practices in honors programs vary from one program to another. The systematic review conducted by Rinn and Plucker (2019) revealed that academic outcomes are attributed to various instructional factors such as higher-ordering thinking skills. University honors programs provide “complex learning-centered and learner-directed experiences” (NCHC, 2013, p. 22) for highly motivated and academically advanced undergraduate students. Recently updated honors frameworks for learning and teaching have emphasized inclusivity across cultural, linguistic, or economic diversity to recruit and retain students from all backgrounds (NCHC, 2022). These

honors students benefit from learning and collaborating with peers and instructors with similar academic levels and interests, which are like gifted education pedagogy applicable to K–12 settings (Colangelo, 2018).

Gifted learners learn with other highly motivated and high-achieving undergraduate students from vastly different backgrounds. Additionally, those backgrounds may be regional, ethnic, cultural, and economically diverse, including non-traditional honors students, including veterans, international students, and transfer students. These diverse settings allow gifted learners to develop collaboration with others.

Table 1

Standards in GPS and HEPP

Gifted Programming Standards	Honors Education Principles and Practices
1.1. Self-Understanding. Students with gifts and talents recognize their interests, strengths, and needs in cognitive, creative, social, emotional, and psychological areas.	
1.1.2. Educators engage students with gifts and talents in identifying their intellectual, academic, creative, leadership, and/or artistic abilities.	
3.1.7. Educators integrate a variety of technologies for students to construct knowledge, solve problems, communicate and express themselves creatively, and collaborate with others in teams locally and globally.	This goal may be achieved through a three-pronged approach: increasing the number of international students through productive partnerships and collaborations, expanding opportunities for students to study abroad, and re-envisioning diverse curriculum to integrate global issues and concerns.
3.4.3. Educators use models of inquiry to engage students in critical thinking, creative thinking, and problem-solving strategies, particularly in their domain(s) of talent, both to reveal and address the needs of students with gifts and talents.	Honors are well-positioned to serve as an innovation hub because interdisciplinary spaces tend to be generative, students have self-selected into a program focused on challenge, team-teaching can lead to cross-disciplinary experimentation, and honors education is a locus of scholarship on novel educational practices.
4.1. Personal Competence. Students with gifts and talents demonstrate growth in personal competence and dispositions for exceptional academic and creative productivity. These include self-awareness, self-advocacy, self-efficacy, confidence, motivation, resilience, independence.	

Table 1

Standards in GPS and HEPP (continued)

4.2.2. Educators provide opportunities for interaction and learning with intellectual and artistic/creative peers as well as chronological-age peers.	
	The honors curriculum may be enhanced by colloquia, undergraduate research, independent-study options, and experiential learning components such as study abroad, service-learning, and academic conference participation, among others. These "high-impact practices" reflect the essence of honors education as "deeper, broader, and more complex." A robust peer mentoring program ensures that new honors students are connected to the many co-curricular opportunities across campus and within the local community via experienced peers. Honors student leaders may be called on to help recruit prospective students, serve on faculty and staff search committees, interact with donors, design co-curricular and social programming, and serve as peer mentors, among many other activities.
4.5.3. Educators ensure access to advanced communication tools, including assistive technologies, and use of these tools for expressing higher-level thinking and creative productivity.	
4.5.4. Educators provide an environment where students use technology to communicate responsibly and express themselves creatively using the platforms, tools, styles, formats, and digital media appropriate to their goals.	

Interventions for Creative Problem Solving

Although empirical interventions to promote creative problem solving in educational and business settings have been widely conducted, the challenge of validating the transfer effects of creative thinking skills remains difficult (Hunsaker, 2005). Despite many claims that creative skills are important to advanced learners, there are limited interventions to date on what specific skills can help learners transfer creative thinking skills in other settings. Because of a lack of intervention studies in education, some interventions mentioned below encompass non-educational settings such as corporate and business realms for adults (Forfeard & Eichner, 2014). Some interventions of creative thinking programs include brainstorming and the STH method (de Bono, 1999).

Creativity Training Methods

Creative training programs include different kinds of tools in which individuals learn to be creative (Scott et al., 2004). In a recent review, Valgeirsdottir and Onarheim (2017) refined the meaning of creative training as "a predefined and structured program consisting of one or multiple sessions, with the main purpose of increasing the creativity of one or multiple participants (p. 432)". Using a systematic process, the authors concluded that the empirical studies on creative training programs must have a clear measure through pre- and post-training, control group, and a sufficient sample size. These tools allow learners to explore different ways to extend their thinking process and transfer their training to authentic contexts. Many of the seminal research studies on creative thinking training have been conducted in university settings (Parnes & Meadow, 1959).

Miller (2018) conducted a study using the survey data from the Senior Transitions module of the National Survey of Student Engagement (NSSE) to investigate the role of transferrable skills in creativity courses among undergraduate seniors. Independent variables

were measured using these two questions: How much confidence do you have in your ability to complete tasks requiring the following skills and abilities? To what extent has your coursework in your major(s) emphasized the following? The dependent variables were creative thinking, critical thinking, entrepreneurial skills, and networking. Based on the Ordinary Least Squares (OLS) analysis, Miller found that exposure to creative coursework had a statistically significant and positive effect on all four skills. What is noteworthy about the study is that creative courses were also beneficial to transferable skills that are related to workforce and entrepreneurial skills. Although the survey results were limited to the sample size and did not represent the entire population of seniors across the United States, the study revealed an important theme that creative training has a positive effect on undergraduate students and that it adequately prepared students for the workforce.

Puccio and colleagues (2018) examined the effects of creative thinking training in a small group and how the skills would transfer to authentic settings. The researchers discovered that participants were adults whose ages were from 30s to late 40s. 559 adults were grouped by four to five members. There was a total of 114 groups. Using a two-way ANOVA, the results indicated that training had a significant main effect on fluency. Group size was also significant. The pairwise comparisons also revealed that those with advanced training in creative thinking developed more creative solutions than the no-training groups. Post-survey results also indicated that the groups who received advanced training in creative thinking were likely to enjoy the small group interaction more than those who did not receive training. Those who received the creative thinking training were more effective in producing fluent, flexible, and original ideas, flexibility, and originality compared to those who relied on their own experiences to solve problems.

Tools to enhance creative thinking at the college level also involve divergent thinking. As discussed earlier, divergent thinking focuses on the quantity of related ideas. According to Paulus and Kohn (2011), a total of 78 undergraduate students from a southwestern university participated, and their mean age was about 21. The participants were assigned one of five conditions (i.e., control, quantity, quality, quantity, and quantity) and then had independent time for 20 min to complete the tasks. After completing the task, they completed a questionnaire to rate their own productivity and creativity. The data analysis was conducted by a trained rater for novelty (how unique the ideas were) and for utility (how much of a positive impact the idea would have) on a 5-point scale, with 5 being a very novel/good idea. The results indicated that those who produced a quantity of ideas without restraint perceived themselves to be more creative. The implication of the study is that generating ideas is an effective way to help learners feel creative.

Another study demonstrated the effectiveness of divergent thinking training. Ritter and Mostert (2017) conducted a study using undergraduate Dutch students on creative thinking training. The independent variable was a set of four creative techniques, including *Silence, random lines of evolution, random connections*, and *SCAMPER*. The dependent variable was creative performance, which was measured by flexibility, fluency, and convergence. The participants received 1.5 hr of training on campus and then were asked to list as many alternative ways as possible to use certain items. Their outputs were measured by two creativity experts on a score range of –5 to +5. An ANOVA was performed on the mean creativity rating of ideas generated during the Alternative Uses Test (AUT; Guilford, 1967) with training as the within-subjects variable and task order (brick–newspaper, newspaper–brick) as the between-subjects

variable. The result indicated that creative training was effective. The limitation of the study was that the intervention was held in a laboratory setting and was not conducted in a natural setting.

In another study, Cropley and Cropley (2000) discovered that divergent thinking training had positive effects on engineering students. In the study, 37 students were in the treatment group and 21 students were business-as-usual. The dependent variable was creative production measured by the experts in the following dimensions: effectiveness, novelty, elegance, and germinality. First, the creativity score differences between the two groups were significant. Secondly, students who created products based on lectures had conventional models in their products compared to those of undergraduates who received creative training interventions. The implication of this study is that divergent thinking training allowed students to create designs that are more novel and original.

Various creative training methods using divergent thinking processes elicit rich and diverse responses from each other. Engaging in dialogic discussions and proposing a wide range of associative ideas enhance students' ability to take multiple perspectives and engage in meaningful conversations to solve real-life scenarios. For this reason, this dissertation study explored ways in which undergraduate honors students can be engaged in dialogic discourse to enhance creative problem solving in small group settings.

The Six Thinking Hats Method

The Six Thinking Hats method (STH; de Bono, 1999) is the creative training intervention used for promoting creative ideas or solutions through thinking in specific directions represented by six different colors. The STH was used as an intervention for this dissertation study. Despite prevalent studies on creative skill interventions, to this date, no empirical study has been conducted with high-achieving students in undergraduate honors programs. Taking multiple

perspectives and providing solutions are important skills that need to be explicitly taught, practiced, and applied in real-life settings. In that light, the STH ‘parallel thinking’, is one of the thinking techniques that enable individuals in a group setting to think in the same direction using color representations (de Bono, 1999). An approach contrary to argumentative or hierarchical thinking, STH allows each member to think in a direction parallel to the others rather than in opposition to solving problems. In other words, it enables the group to explore different perspectives and ideas more efficiently, leading to more productive and effective outcomes (Schellens et al., 2009).

Features of STH

The STH method proposes that there are six distinct ways of thinking, each of which is represented by a different colored hat. The representations of each Hat in the Six Thinking Hats are as follows (de Bono, 1999):

● White Hat: This Hat represents objective and factual thinking. It involves looking at the available information and data, analyzing it, and making conclusions based on the evidence.

● Red Hat: This Hat represents emotional thinking. It involves looking at the situation from an emotional perspective and considering feelings, hunches, and gut instincts.

● Black Hat: This Hat represents critical thinking. It involves looking at the situation from a critical perspective and considering potential problems, obstacles, and risks.

● Yellow Hat: This Hat represents optimistic thinking. It involves looking at the situation from a positive perspective and considering opportunities and potential benefits.

● Green Hat: This Hat represents creative thinking. It involves looking at the situation from a fresh and innovative perspective and generating new ideas and solutions.

● Blue Hat: This Hat represents reflective thinking. It involves looking at the thinking process itself and considering the overall goals and objectives.

Based on the principle of parallel thinking, STH requires that all members of a group think in the same direction at the same time, focusing on one Hat at a time. This approach eliminates the problems associated with traditional argumentative thinking, where different individuals have different perspectives and may argue with each other, leading to conflict and a lack of progress (de Bono, 1999). Further, this roleplaying allows students to generate new ideas or solutions to given situations or problems.

Implementation Procedures of STH

The implementation procedures of de Bono's (1999) Thinking Hats involve the following steps:

1. Identify an Issue: The first step is to clearly identify the issue or situation.
2. Introduce the Hats: The next step is to introduce the six different Hats and to explain the role of each Hat in the thinking process.
3. Focus on One Hat at a Time: The group should then focus on one Hat at a time, with all members adopting the same Hat and considering the situation from that perspective.
4. Sequence Hats: The group should sequence Hats as necessary, moving from one Hat to another as they work through the thinking process.
5. Record Ideas and Conclusions: The group then records their ideas and conclusions as they move through the thinking process to ensure that nothing is missed and to provide a record of their thinking.

6. Evaluate Results: Once the group has considered the situation from all six perspectives, they will evaluate their results and consider any potential next steps or actions that need to be taken.
7. Practice: Finally, it is important to practice using the thinking Hats model on a regular basis to build familiarity and confidence with the approach.

The STH model can be used in a variety of contexts, including problem solving, decision-making, brainstorming, strategic planning, discussions about a topic for all age groups. It can be used by professionals and students of any age, and it can be adapted to suit different situations and needs. Research has shown that the STH method can be an effective tool for enhancing creativity, improving problem solving, and promoting collaborative thinking (Blijleven et al., 2020; de Bono, 1985; Khoo et al., 2015).

Effects of STH on Professionals

In recent years, there has been a growing interest in de Bono's (1985) STH method and its potential applications in various fields. This growing interest signals the importance of gifted learners in undergraduate honors courses to be prepared to be creative problem solvers. A review of the literature reveals several studies that have explored the effects of STH on critical thinking, problem solving, and decision-making with professionals in different contexts. First, Kenny (2003) investigated the effectiveness of STH in a palliative care scenario, where nurses, doctors, and other medical staff were asked to critically reflect on their thoughts and actions in hypothetical situations. Although the article did not explicitly state who provided the intervention, researchers found that the STH method helped the participants reflect more critically and gather data on whether the method could increase responsiveness and responsibility for nurses and patients. The results indicated that the STH method can be an effective tool in

promoting reflection in palliative care and improving the quality of care provided to patients and their families. The author suggested that the method can be used in other healthcare settings and called for further research. Second, Azeez (2016) conducted a quasi-experimental study to investigate the effect of online instruction using STH on a group of 48 social workers. In the study, the author provided two-day training on how to use the STH in an online setting. The results showed that the STH method had a significant positive effect on the social workers' Creative Innovative Scale scores. The social workers who received training on STH viewed the thinking strategy favorably, demonstrating the potential for STH to improve critical thinking and problem-solving skills in social work.

Further, Vernon and Hocking (2014) conducted an experimental study with 100 adult volunteers with a wide range of professional backgrounds to explore the potential use of STH for explicit scaffolding in the thinking process. The participants were given problems and then were asked to generate different ways to express the problem within 3 min. Their performance was measured in terms of the fluency, quality, and originality of the responses. Each participant was asked to wear a specific hat and generate as many ideas as possible. The study found that the treatment group that used the STH technique produced greater originality in problem-solving skills compared to the control group that did not use any specific thinking skills. This study demonstrates the potential of STH for explicit scaffolding in the thinking process and highlights its effectiveness in improving problem-solving and critical thinking skills among professionals.

Lastly, Hu et al. (2021) explored the ways in which shifting the Thinking Hats in the STH method would influence the design or problem-solving skills. Eight design experts who worked in the technology and commercial industry participated in the study. The researchers found that participants would select and shift the Hats according to different situations, and the shifting

patterns in different thinking-hat sets were related to the characteristics of these sets. The study also found significant differences in shifting relationships between groups on different design creativity levels and proposed effective intervention measures and strategies to stimulate the process of shifting group members.

Adult learners in different settings that included face-to-face and online settings associated STH favorably. Based on the studies above, STH has provided better ways to solve difficult problems and has yielded positive opinions from those who used it as a technique. For undergraduate honors students who are preparing for future careers that are highly selective and competitive, STH offers multiple pathways for them to be hired in positions as leaders and consultants by considering issues from multiple angles and driving toward potential solutions.

Effects of STH on Students

In addition to its use among adults across professions, STH has been used as an instructional tool in school settings across elementary to university-level classrooms to improve psychosocial skills, which are soft skills developed through life experiences such as conflicts and tension (i.e., persevering through hardship, listening actively, communicating effectively; Erikson, 1963; Rinn, 2022).

Psychosocial Development

Navigating various social situations is one of the critical skills required to solve critical issues and problems. Specific communication skills require students to actively listen to each other and build upon each other's ideas (Rinn, 2022). Coined by Erikson (1963) to describe skills students develop throughout the stages of their lives, *psychosocial development* is a subskill that can be cultivated through Six Thinking Hats to extend beyond academic skills high-achieving students need. In addition, appropriate psychosocial interventions high-achieving students from

diverse backgrounds with opportunities to build interview or job-related skills. Research shows that these students may not have received gifted education services from elementary or secondary school years because of cut-off scores, a lack of gifted education teacher referrals for gifted programming, an absence of localized gifted education plans, or limited exposure to challenging courses (Peters & Carter III; Ritchotte et al., 2015; Rose 2013; Sewell & Goings, 2020).

Additionally, some researchers concluded that these high-achieving students from diverse backgrounds benefit from collaboration, reflectivity, and other types of social skills, which are also integrated into the STH method. Schubert and colleagues (2022) conducted a pre- and post-test design that measured the impact of the 2-week bridge program for 24 first-year high-achieving university students from diverse backgrounds. The program, which partnered with the university honors program, offered mentorship and the STH method for idea generation and creative thinking. Although negligible differences in the pre- and post-test survey existed, the exit survey collected showed that 96% of the students responded that the class was innovative and that 88% of them felt that it helped them develop their thinking to be more creative. Since STH allows individuals with specific-colored Hats to participate and listen to others who think differently to solve issues or problems, students are positioned to exchange ideas and lead conversations with each other without argumentation or in opposition to each other's views.

Several studies demonstrate evidence of how STH can be used to develop psychosocial skills in students. For example, Chien (2021) conducted a qualitative case study in which nine student teachers were interviewed and observed throughout a year and discovered that the STH allowed teachers to be more reflective of different aspects of teaching practices by engaging

them to think comprehensively about different aspects of their values, beliefs, and emotions. In addition, the STH instruction led the student teachers to develop a deeper understanding of their teaching practices and identify areas for improvement.

Additionally, the study by Huang and colleagues (2021) revealed that STH was used as a counseling tool to help students gain multiple perspectives on themselves. The pre- and post-test quasi-experimental study included three 7th grade groups in treatment and three 7th grade groups in control group. The researchers provided a guide on the use of STH method for small group interactions. Then they were asked to reflect and consolidate key learning points. To measure their creativity, creative tendency, and self-concept, the researchers used post-test scores of The New Test of Creative Thinking (NTCT-Figural), The Williams Assessment of Creative Tendency (WACT), and Elementary School Student Self-Concept Scale (SCS) results as the dependent variables. The researchers' ANCOVA results indicated that the treatment group demonstrated significant effects (i.e., fluency [$p < .001$]); flexibility ($p < .01$); originality ($p < .001$); elaboration ($p < .001$); self-concept ($p < .05$). Although the participants were middle school students, the relevance of the study is that the STH was a potential tool to develop high-achieving university honors students' perspectives of themselves and others related to real-world problems.

Multiple Perspectives

In this light, the STH method provides opportunities for introverted university honors students to engage in purposeful dialogue by viewing issues or problems from different angles and perspectives and actively contributing their ideas (Clarke et al., 2016; Engin, 2017). The following research articles reflect STH as an instructional technique to enhance students' creative problem solving.

First, the STH methods is used to enhance problem-solving skills and is less connected to personal experiences. For example, Clausen et al. (2021) used a survey to classify speech-language pathology (SLP) students' preferred lateral thinking style based on de Bono's STH. The study sought to determine if an association existed between a given SLP student's level of clinical experience. The study found that students' level of clinical experience was not significantly associated with their parallel thinking style, which led the authors to assume that training in thinking skills could enhance the students' ability to solve novel problems.

Further, STH also helps undergraduate honors students generate more ideas to solve problems. Kaya (2013) conducted a quasi-experimental study to compare the impact of the STH technique on the treatment and controlled group of students in geography classes. After the 42-multiple question and two open-ended question pretest on a unit of geography was taken, the treatment group received an intervention with the STH, while the control group received a traditional method of didactic teaching. Although the length of the intervention was not stated, the *t*-test on the length of the written expressions through pre- and post-tests revealed that the STH influenced students' understanding of the unit. The study found that thinking from multiple perspectives can lead to increased creative and critical thinking skills about given content or a unit of study.

Overall, the studies above provide evidence for the potential of STH as a teaching and problem-solving method through ongoing collaboration and conversation as a group. STH encourages students to think from multiple perspectives, leading to increased depth and complexity in solving difficult problems. Also, the method is relevant to this dissertation research study within honors education provided a platform for interdisciplinary studies in which the STH is relevant to any subject area regardless of content specificities.

Summary

The background literature in this chapter provided an overview of the creative thinking interventions and factors that promoted creative problem solving in the context of schools and corporate settings. The STH method (de Bono, 1999), a parallel thinking framework in which participants assume a specific role led by the color representations of the Hats, has often been used as an intervention among various professionals and students to problem-solve issues; however, limited literature on the use of STH method as an intervention to promote creative problem solving (i.e., multiple perspectives, active participation, creative ideas, and verbal outputs) among university honors students provided a first step in determining whether there is a functional relation.

CHAPTER 3: METHOD

The purpose of this research study was to determine if a functional relation existed between the Six Thinking Hats (STH) method and creative problem solving among introverted university honors students. A functional relation means that there are at least "three demonstrations of effect" (Ledford & Gast, 2018, p. 81) across conditions observed in visual analysis through level, trend, and variability. Level means the amount of desired behavior change that occurs as a result of intervention; trend refers to "the slope and direction" (p. 185) of the series of data that moves across over time; and variability is "the range of data values" (p. 185) within each condition.

Four primary research questions guided the research:

1. To what extent will the STH method increase the number of perspectives, measured as the total count of Thinking Hats, shared by introverted university honors students during small group discussions?
2. To what extent will the STH method increase the number of topic-related participation units shared by introverted university honors students during small group discussions?
3. To what extent will the STH method increase the number of creative thinking ideas using the Green Hat by introverted university honors students during small group discussions?
4. To what extent will the STH method increase the number of topic-related words per Thinking Hat shared by introverted university honors students during small group discussions?

In addition, a secondary research question included:

5. What are introverted university honors students' perspectives on the use of the STH method within and outside of the honors classroom setting?

I used a single-case multiple baseline design to examine the effects of the STH method on creative problem solving among four introverted university honors students to answer the first four research questions. This research design allowed me to observe a causal relation between the parallel thinking method (i.e., STH) and creative problem solving that adds to the few single-case design studies in gifted education (Dai et al., 2011; Plucker & Callahan, 2019; Simonsen & Little, 2011). In the following sections, I provided information regarding the participants, setting, materials, dependent variables, procedures, potential threats to validity, social validity, and data analysis.

Participants

Participants included four university honors students enrolled in a semester-long 3-credit elective course, *Creativity and Creative Problem Solving*, offered by the Evanston Honors Program (EHP [a pseudonym]). To be considered for the EHP, students must be "academically motivated" (Honors College, 2024) compared to their university peers. As a graduation requirement of the program, these honors students must participate in capstone projects that entail research, writing, and oral presentations (Honors College, 2024). To participate in the study, they met the six inclusion criteria: (a) enrolled in the EHS, (b) enrolled as a junior or a senior, (c) maintained a minimum GPA of 3.0 in overall subjects and 3.2 in honors courses, (d) received no prior training on the STH method, (e) scored the lowest on the extroversion dimension of the International Personality Item Pool's Big-Five Factor Markers (IPIP) self-report inventory among all students in the class, (f) identified as gifted in K–12 and/or took advanced coursework in secondary school years, and (g) spoke English as one of the languages at home. The rationale for the below-average scores in extroversion is justified through research-based studies on the characteristics of introverted students (Chen et al., 2022) and their

relationship to social and verbal outputs. *The Big Five Theory of Personality* is one of the most-researched constructs on personality types (Rinn et al., 2022), and extroversion has been correlated to talkativeness, social relations, and leadership (Costa & McCrae, 1992; Young et al., 2018). The students scoring the lowest on the extroversion dimension in the classroom are less likely to participate in small group discussions associated with social risks and social perceptions (Davidson et al., 2015); therefore, the focus of the dissertation study investigated the effects of an intervention that could highlight introverted students' multiple perspectives and creative ideas through their active participation.

I used the students' demographic survey (see Appendix A) and the IPIP self-report inventory data (Goldberg, 1987; see Appendix B) to screen honors students for their eligibility. Upon obtaining the University Institutional Review Board (IRB) approval and the students' consent forms, I shared the demographic survey they could complete as a non-graded homework assignment. After students submitted the demographic survey, I provided the IPIP survey for them to complete in class. The demographic survey allowed me to verify student eligibility for all criteria except item (e). Students who met the eligibility criteria based on the demographic data must also have the lowest scores comparatively to other students in the class on the extraversion dimension on the self-report inventory.

Out of the 10 students who consented to participate, four students met the criteria based on the demographic survey (see Table 2) and the IPIP survey (see Table 3). To protect their identities, I used new pseudonyms (i.e., Eliza, Ender, Brian, and Lori) different from the pseudonyms the students selected for small group discussions.

Eliza

Eliza was a White female and a junior in the EHP. She participated in a gifted program throughout her elementary school years and then took honors classes in middle school. In high school, she participated in dual enrollment and Advanced Placement (AP) courses (AP Central, 2024). She did not know about the STH; however, she mentioned in the survey that she always tried to think creatively when solving problems. Her extroversion score ranked 11th out of 12 students who took the survey in the course in the order of highest to the lowest.

Ender

Ender was a White male and a junior in the EHP. His parents homeschooled him until he attended the university, and he never received gifted education programming. In high school, he took online AP courses (i.e., U.S. History, A.P. Chemistry, and A.P. Calculus BC [introductory college-level calculus course]; AP Central, 2024). He did not have any knowledge of the STH method; he stated that he did not know any creative problem-solving strategies. He reported that he had no experience in creative problem solving. His extroversion score ranked 12th out of 12 students who took the survey in the order of highest to the lowest.

Brian

Brian was a Black male and a junior in the EHP. He did not participate in the gifted education program during elementary and middle school years. In high school, he took AP courses (i.e., Biology, Psychology, and World History). Like Eliza and Ender, he also did not have any knowledge of the STH; however, he mentioned in the survey that he used creative problem solving in sports, school, and life. His extroversion score ranked 10th out of 12 students who took the survey.

Lori

Lori was a White female and a junior in the EHP. She enrolled in the gifted education program during elementary and middle school years. During middle school, she took honors courses. In high school, she took honors, dual enrollment, and AP courses. Lori also did not have any knowledge of the STH. She shared that she used creative problem solving in her high school marketing course to create a product for a project. Her extroversion score ranked 9th out of 12 students who took the survey.

Table 2

Student Demographic Information

Variables	Eliza	Ender*	Brian	Lori
Gender	Female	Male	Male	Female
Race	White	White	Black	White
Grade	Junior	Junior	Junior	Junior
Field of Study	Engineering	Science	Sports	Finance
Types of Advanced Courses in Grades 9–12	Dual enrollment; AP Courses	AP U.S. History AP Chemistry AP Calculus BC	AP Biology AP Psychology AP World History AP American History	Dual enrollment, AP Courses; Other college-level courses

Note. * Ender was homeschooled throughout K-12 and took online courses for advanced courses.

Table 3

Descriptive Information of the Participants' International Personality Item Pool Scores

Participant	Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness	Rank
Eliza	2	3.8	4.1	2.7	3.3	11th
Ender	1.8	3.5	3	2.3	4	12th
Brian	2	3.8	2	3.4	3.3	10th
Lori	2.9	4.1	4.4	1.9	4	9th
Mean *	3.12	3.85	3.58	2.60	2.9	
Min-Max *	1.80-4.40	3.50-4.80	2.00-4.80	1.90-3.40	2.90-4.50	

Note. * The mean and ranges are for the 12 students in the class.

Experimenter and Secondary Observers

I led the research study as a primary investigator and experimenter. After spending 10 years as a middle and high school classroom teacher and a gifted specialist in school districts, I earned a Master of Education in Literacy and a Master of School Administration. I received accreditation and a certificate as the Six Thinking Hat Trainer from de Bono Group LLC (n.d.) and led training with the Chief Executive Officer of the company for the past year. For this study, my responsibilities included obtaining IRB approval, disseminating and collecting consent from honors students, providing the intervention, and collecting and analyzing data on honors students' multiple perspectives, participation, creative thinking, and number of words per Hat. As a doctoral student in special education, I co-taught the honors elective course, *Creativity and Creative Problem Solving*, in 2022, with the course instructor and was familiar with honors

students' characteristics and the course topics on *Creativity and Creative Problem Solving* (see Appendix J).

To determine phase changes, a professor in Special Education who specialized in single-case design research was the secondary decision maker. Three doctoral students with expertise in special education and gifted education volunteered to conduct secondary coding for quantitative and qualitative data, procedural fidelity, interobserver agreement, and/or thematic analysis for social validity. The course instructor, who was also my dissertation chair and an advisor, also conducted procedural fidelity.

Setting

The Evanston Honors Program

The study took place at a mid-sized public university located in an urban area in a Southeastern state. The university established the undergraduate honors program in 1968 and had been designated as a high research-activity university. Based on the up-to-date university's undergraduate demographic data from 2022, 49.7% of the students identified themselves as White, 16.5% as Black, 12.2 % as Hispanic, 8.7% as Asian, 6.5% as International, 4.4% as multiracial, and 0.3% as American Indian. Males were 49.7% and females were 50.7% of the student population (University Diversity Dashboard, n.d.).

According to the university honors website at the time of the study, student applicants must obtain an unweighted GPA of 3.2 from high school and 3.4 from college for transfer students to enroll in the EHP. To graduate from the EHP program, the students must maintain a 3.0 overall GPA and 3.2 GPA in honors coursework. Student applicants must achieve a minimum test score of 1,100 for the Scholastic Aptitude Test (SAT) and 22 on the American College Testing (ACT). Other criteria in the application included a list of activities, a personal

essay, and two letters of recommendation from an instructor (University Honors College: Academic Affairs, n.d.).

Based on the university website, the graduation requirement included a capstone project. To prepare for the capstone project, students must take an honors seminar course on research methodology and intensive writing instruction. The EHP offered *Creativity and Creative Problem Solving* as an elective course for honors juniors and seniors. The class met face-to-face on Tuesdays and Thursdays from 10:00 A.M. to 11:15 A.M. during the spring semester of 2024. The student/teacher ratio in the honors classroom was 13:1. The course instructor was an associate professor in gifted education and taught the university honors course for the past 3 years using the Creative Problem Solving framework ([CPS], Creative Education Foundation, n.d.) and was also my dissertation chair. The course topics included theories of creativity, methods of creative thinking, and the stages of CPS (see Appendix J).

Classroom

Data collection for the study occurred in Elon Hall (a pseudonym), which included the administrative offices for the Honors College and residential floors for undergraduate honors students at the university. The administrative side of the building had two seminar classrooms and a work-study area on the first floor as well as a conference room and another work-study area on the second floor. The seminar classrooms functioned as multi-purpose spaces that contained nine mobile rectangular desks with 20 chairs placed around the desks facing the computer podium and a rolling screen projector. The course took place in one of the two seminar spaces. I reserved two conference rooms where I could pull groups of honors students for training, intervention, and maintenance phases.

Research Design

To evaluate the effects of the STH method on the creative problem solving and participation behaviors of four introverted honors students in a classroom setting for Research Questions 1–4, I used a single-case, multiple baseline design across participants (Ledford & Gast, 2018). The rationale for selecting the design was that the studies about measures of creativity in higher education have been mainly descriptive or observation in nature with little evidence for transfer effects in classroom settings (Snyder, 2019). One of the characteristics of the single-case design is that a participant ($N = 1$) is their own comparison unit (Ledford & Gast, 2018). The flexibility of the single-case design is in implementation and evaluation of rapid, multiple interventions that may be modified based on ongoing data patterns (Carr et al., 2014; Zettle, 2020). Since introverted honors students are perceived to display limited verbal participation in group conversations (Liang & Kelsen, 2018; Martin-Raugh et al., 2023), the multiple baseline design integrated a structured method to observe if causal relations existed between the intervention and creative problem-solving behavior with each participant.

In addition, the multiple baseline design allowed me to apply a time-lagged approach across a group of introverted honors students in that the training and intervention were introduced at a different point in time, permitting me to verify a functional relation between the STH and problem-solving abilities by controlling for time-specific confounds (Ledford & Gast, 2018). The baseline data collection was ongoing until stable performance of zero, one, or two Thinking Hat tendencies was obtained for at least six sessions. I used the first dependent variable (i.e., total count of perspectives measured by the total number of Hats) to make phase change decisions.

Materials

The materials used for the study included a set of 4” x 6” index cards with a focused issue printed on them, Canvas (i.e., learning management system [LMS] provided by the university), and three audio recorders with group labels to record small group discussion. Student materials included: (a) an online Google survey to collect demographic information (see Appendix A); (b) an IPIP survey (see Appendix B) transcribed into a Google form; (c) the focused issues to prompt the students’ discussions generated by Chat GPT (see Appendix C); (d) the folders that included Six Thinking Hats method definitions, descriptions, and sentence frames for small group training (see Appendix D); (e) the experimenter’s training script (see Appendix E) and intervention scripts (see Appendix F); (f) the baseline and maintenance scripts (see Appendix G), the data collection sheets (see Appendix H), the fidelity checklists (see Appendix I); and (g) transcriptions from Temi, an online transcription company.

Developing Focused Issues

To provide equivalent focused issues appropriate for college and university-level students (Atlas, 2023; Dai et al., 2023), I used the Generative Pre-trained Transformer (GPT), an online language model (OpenAI, 2023; Sabzalieva & Valentini, 2023) trained on global text datasets to produce outputs based on specific queries. First, I input the following directions: “Generate 30 problem-solving scenarios based on the following criteria: (1) Each scenario must be 1–2 sentences, (2) Each scenario must be relevant to the perspectives of emerging adults, young adults, college, or university students, and (3) The issue must encompass a wide range of topics, current events, and problems” (see Appendix N). The outputs included a topic of interest followed by one to two sentences describing a problem, conflict, or dilemma.

Next, I refined the focused issues to increase consistency in the language and number of sentences and provide more ambiguity for open-ended discussions after obtaining feedback from a university professor outside of Special Education to verify their relevance, consistency, and appropriateness. An example of a focused issue generated by Chat GPT was, “A group of college students is deciding on a topic for their cumulative semester project, but they have diverse interests, making it challenging to reach a consensus by the due date.” To make the statement more relatable and realistic, I refined the statement as, “Your group is working on a cumulative semester project, but several of them are not pulling their weight, making it challenging to complete the project by the due date.” Lastly, to control the focused issue as a potential confounding variable (e.g., more relevant and interesting to a participant), I used Google’s random generator to select a topic for each small group discussion session.

Dependent Variables and Measurements

I measured four variables for this study. The primary variable was the number of Thinking Hats, for which I counted the number of Hats each participant used per small group discussion session. For the second dependent variable, I counted the number of topic-related participation units by reporting the number of participation units. I also counted the number of creative ideas (i.e., Green Hat). The fourth dependent variable was the number of on-task words per Hat (see Appendix D).

Total Number of Thinking Hats

The primary dependent variable was the total count of Thinking Hats a participant shared per session. Represented by colors (e.g., red, white, yellow, black, blue, and green), each Hat symbolizes a disciplined way of thinking. For example, White Hat symbolizes information and objectivity; Red Hat means a hunch or feelings about the problem; Black Hat is all about risk

management and thinking with a critical lens; Yellow Hat has to do with a positive way of thinking about the problem; Green Hat symbolizes alternative ideas; and lastly, Blue represents control and facilitation (de Bono, 1999). See Figure 2 for a detailed description of each Thinking Hat.

I counted the number of different Hats used, not the number of times the same Hat was used. For example, if a participant used the Red Hat three times during a session, I counted for the presence of the Red Hat regardless of how many times it was used. Further, a participation unit was counted as only one Hat. For situations where multiple Hats were presented within a student's turn speaking, the second coder and I decided on a single dominant Hat represented in the student's last two sentences. The mastery criteria for phase change from baseline to intervention was at least four Hats, and maximum number of Hats a participant could demonstrate would be six. The rationale for counting the number of Hats involved examining the degree to which a participant engaged in multiple perspectives on a given topic during small group discussion.

Figure 2

The Six Thinking Hat Definition, Symbols, and Behavioral Descriptions (de Bono, 1999)

Thinking Type	Symbols	Behavior Descriptions
	information, objectivity, impartiality	• Information I know or need • How the information can be obtained • Determine accuracy and relevance
	intuition, hunches, emotions, feelings	• Permission to express feelings • No need for justification • Gut feeling • One or two words to express feelings
	logical managing risk	• Points of potential problems • Reasons must be given • Point out thinking that does not fit the facts, experience, regulations, strategy, or values
	speculative, positive	• The optimistic view • Reasons must be given • Needs more effort than the Black Hat • Finds the benefits and values • Considers both short and long-term perspectives
	creative	• Creative thinking • Seeks alternatives and possibilities • Removes faults • Doesn't have to be logical • Generates new concepts
	control, monitoring, summary, focus program design	• Organizes thinking • Sets focus and agenda • Summarizes and concludes • Ensures that the rules are observed

Total Number of Topic-Related Participation

For the second dependent variable, I recorded the number of on topic-related participation (TRP) units per session. In this study, I defined participation as a continuous verbal statement a participant expresses at a given time during small group discussions (Casa et al., 2020). The term means a statement, question, or response to another student about a topic (see Appendix G). Counting the number of participation units serves to assess the level of engagement demonstrated by verbally sharing ideas, elaborating on concepts, and proposing solutions with others in small group discussions. The inclusion criteria for a single unit of TRP consisted of a continuous verbal output related to the topic and the first word to the last word spoken. When an individual interrupted a participant during the session, I counted the continuation of the participant's verbal output after the intervention as a new unit of participation. If participants expressed jokes, side comments, or mentioned a topic unrelated to the focused issue, the participation unit was not counted.

Total Number of Creative Thinking Ideas

Along with the participation unit count, I counted the total number of creative thinking ideas shared by each participant during the Green Hat discussion. Creative thinking demonstrates students' ability to adapt and solve complex problems through unique and meaningful ideas. I defined creative thinking as alternative and unusual ideas verbally expressed during small group conversations (de Bono, 1999; Gilford, 1950). For example, Guilford developed the AUT (1967) in which individuals would name as many uses as possible of a brick (Guilford, 1975; Kaufman, 2016). Similarly, Green Hat participation allowed participants to verbally express novel ideas. I first identified participation units that used the Green Hat (i.e., unitize the data) and then counted alternative or novel ideas. The inclusion criteria for counting creative ideas encompassed the

following: (a) the idea must be novel or new, and (b) the idea did not have to require logical or realistic explanation or rationale. An example of Green Hat thinking on the topic of how to motivate college students to be punctual was "to offer a full semester tuition refund if students arrive on time to class for the entire semester." The statement counted as a novel idea although not realistic. A nonexample of Green Hat thinking on the same topic would be, "Just be punctual and not be late" because this suggestion reaffirms the existing expectation without introducing an alternative idea.

Total Number of Topic-Related Words Per Hat

For the fourth dependent variable, I recorded the total number of topic-related words per Thinking Hat during each session. Counting the number of words spoken per Hat revealed how much the participant talked in that specific Hat during small group conversations (Nippold et al., 2014). This dependent variable was an extension of the primary dependent variable (i.e., total count of Thinking Hats); once I determined the specific Hat used, I counted the total words for each Thinking Hat to show participants' thinking process. The criteria for counting words of an individual included words spoken by a participant related to the topic. I excluded filler words, such as "um," "like," "okay," and "you know," from the topic-related words. I also removed consecutive duplicates of the words or self-correction of mispronounced words. Similar to the nonexamples of the on-topic related participation, if participants expressed jokes, side comments, or mentioned a topic unrelated to the focused issue, the participation unit was not counted.

Interobserver Agreement

I trained a secondary observer, a doctoral student in Special Education, to conduct interobserver agreement (IOA) for the first four dependent variables (i.e., total number of Six Thinking Hats, total number of topic-related participation units, total number of Green Hats, and

total number of topic-related words per Hat). Because the interobserver was not available to attend the class in person, she completed the IOA after class by accessing the transcriptions and recorded audio files in a secured Google folder. The training process involved two steps. First, the observer and I reviewed the definitions and examples for each dependent variable during each data collection session. Then the observer and I read the first transcription from the first session and then jointly scored together for practice and clarification. If there were any disagreements, we discussed and resolved the disagreements. Next, we listened and read a second transcription from the second session and then independently counted the number of Thinking Hats, topic-related participation units, creative thinking ideas, and topic-related words. For any disagreement on the counts, we reread the transcription together to reach a consensus on items in which disagreement occurred. The secondary observer and I continued this step until an agreement was greater than 90% across two consecutive sessions for all dependent variables (Ledford & Gast, 2018). The secondary observer then checked at least 30% of the data on all dependent variables across the experimental conditions for the four participants. Because the class met every Tuesday and Thursday morning, the observer and I met biweekly after class to discuss agreements and resolve discrepancies. I calculated the IOA using the point-by-point agreement method and divided the number of agreements by the number of agreements plus disagreements and multiplied by 100 to yield a percentage across all dependent variables.

Social Validity

First coined by Wolf (1978), social validity is a specific term that refers to confirming the relevance of the goals of the intervention and the appropriateness of the procedures, and the results must be socially significant for participants. To collect social validity data, I conducted interviews with the participants at the conclusion of the study. The setting of the interviews was

an office next to the classroom and took place over 2 days after the maintenance data collection was complete. The interviews with Brian and Lori occurred on May 2, 2024; whereas the interviews with Eliza and Ender occurred on May 3, 2024.

A week prior to the interview, students signed up on Google calendar to book an appointment to participate in a 30-min interview with me. The interview took place outside of class, and each student received a gift card of $25 for their participation (see Appendix K). I used a qualitative approach by formally interviewing the participants and used thematic analysis (Braun & Clarke, 2006) to systematically examine the phenomenon of the STH method as experienced by the honors students (Braun & Clarke, 2016; Corr et al., 2019; Snodgrass et al., 2024). The qualitative approach to the honors students' perspectives on the use of the STH revealed insights about the social validity of the intervention effects on the participants (Ledford et al., 2023).

Epistemological Stance

I framed university honors students' perspectives through a constructivist stance that assumes their observations and views create and reveal multiple realities about their beliefs, perspectives, and experiences (Crotty, 1998; Merriam & Tisdell, 2016). By doing so, I "get as close as possible to the participants being studied" (Creswell & Poth, 2018, p. 21) and understand how these are influenced by their experiences in this course and the intervention. Based on the epistemological stance, the interview questions were open-ended and semi-structured (see Appendix K).

Reflexivity

Demonstrating trustworthiness of the thematic analysis included disclosing the values and experiences I brought to the interview data (Creswell & Poth, 2018). Before I analyzed the

transcript from the interview data, I engaged in bridling (Dahlberg & Dahlberg, 2004), a purposeful and deliberate reflexive approach that allowed me to examine the phenomenon with openness and flexibility (Vagle, 2009). Unlike bracketing biases, a reduction technique that aims to set aside one's assumptions and pre-understanding before analysis (Merriam & Tisdell, 2016), bridling positioned me as part of the whole experience of the phenomenon (Vagle, 2009). Using a Google document, I committed to writing my thoughts before, during, and after analyzing the interview transcriptions of the four participants. For example, before I interviewed the students, I jotted down my thoughts on potential dynamics during the interview and revisited the interview questions to include both the positives and challenges of using the intervention (see Appendix I). Additionally, the setting where the interview took place was outside of the classroom so that students would be more at ease to share their thoughts. Furthermore, continued monitoring of the experiences related to the phenomenon of interest helped me reflect on the extent to which my professional and personal experiences and values in gifted education both extended and limited the data collection and analysis process (Peshkin, 1988).

Procedures

Day 1

Several days before the first day of the course *Creativity and Creative Problem Solving*, the course instructor unlocked the Canvas course module for students to access the syllabus, along with the *Consent to Participation in the Research Study* (Appendix A) and *Multi-Use Audio Recording Form* (Appendix B). She also sent students a welcome email that included what to anticipate for the first day of class. When students entered the classroom, they saw a written direction on the PowerPoint slide: (a) sit anywhere they like, (b) write their names at the front and back of name tents, and (c) be ready to share their names, majors/minors, and areas of

interest, passion, or talent. They also saw three consent forms on the table: The Consent to Research Study form (see Appendix A), Consent to Interview Form (see Appendix B), and Consent to Audio Recording Form (see Appendix C). As they walked in, they picked one form each and sat at a table of their choice.

Recruitment. After students took turns to share about themselves as a whole group, the course instructor introduced me as a doctoral candidate conducting studies in gifted education. I shared how excited I was to be in class for the second time. I highlighted the benefits of this course and how their learning in this course would not only positively enhance their capstone projects and postsecondary career pathways but also provide fulfillment as creative individuals.

After my brief introduction, I used the class PowerPoint slide to share about my dissertation project on the STH method, rationale for the study, and how the study would potentially contribute to improving honors education at college levels. I highlighted how students could support this study as participants in the study and emphasized that choosing to participate or not participate in the study would have no impact on their grades, homework, and projects. I also shared that even if they chose to participate now, they could always withdraw at any point in the study. There was a reminder to submit the form in the class's PowerPoint slide, and students had access to the forms through Canvas. I shared that I would place a manila envelope at the table during the next several class sessions to collect their forms. Once the forms were collected, I locked them away in a filing cabinet located in my university office.

Day 2

All students (i.e., both participants and non-participants) in the course practiced the data collection procedure with me on the second day of the course, which was a typical part of the course. First, they entered the classroom with the same table and chair arrangements as it was on

Day 1. Students selected their own seats. For the small group discussions, I distributed 4" x 6" cards with some open-ended questions built into the warm-up questions for students to get to know each other (i.e., Have you ever asked someone for their autograph? What is your favorite action movie? Why? [The Colbert Questionert, n.d.]). I also provided three audio recorders, one per group. The rationale for using an audio recorder during this practice session was to reduce the Hawthorne Effect and the influence of the presence of the audio recording device (Nordstrom, 2015) for the actual data collection. I said that this practice would be part of the normal routine in class for small group discussions (regardless of whether a student chose to participate or not to participate in the study). I asked for a volunteer in each group to pick up the recorder and say the date, time, and the words *start recording* and *end recording* at the beginning and the end of the recording, respectively. When the small group discussion and recording were complete, a volunteer student returned the audio recorder to me. This procedure helped participants familiarize themselves with the baseline, training, and intervention phases.

Screening Process

The honors students, who returned the Consent to Participate Form and Consent to Audio Record Form, completed the IPIP survey as part of the required component of the course. I opened the Google Form as a spreadsheet and labeled it as "STH Personality Trait Data," which I converted the item scores into scaled scores for percentages for each factor: Extraversion (Factor 1), Agreeableness (Factor 2), Conscientiousness (Factor 3), Emotional Stability (Factor 4), and Intellect/Openness to Experience (Factor 5). The items were not grouped but distributed with other factors. When scoring, each item was listed into "+keyed" and "–keyed" items and were added to convert into scaled scores. Based on the demographic and the IPIP survey data, the four undergraduate honors students who received the lowest extroversion dimension scores

were selected as the target participants whose data were graphed for the visual analysis. I placed all enrolled students in three groups, with four or five students in each group. Group 1 and Group 2 had one target participant each, and Group 3 had two target participants.

General Procedures

For each class session, students in the class were engaged in 20-min small group discussions, which were held before direct teaching or lecture based on the course schedule. Both participants and non-participants engaged in small group discussions for each class. I asked all students (i.e., target participants and non-participants) to write their pseudonym and preferred name on opposite sides of their name tent. When students were engaged in small group discussions, they flipped their names to have their pseudonyms displayed to their classmates. The total number of students in class was 13, so two small groups consisted of four students and the third group consisted of five students. I placed Eliza in Group 1, Brian in Group 2, and Ender and Lori in Group 3. Next, three students who scored the highest in extroversion were placed in each group. The remaining students with similar scores were randomly placed into the groups.

The small group discussion occurred every session from Day 3 of the course to the last day of the course. The groups remained consistent throughout the study; however, two adjustments occurred because of variability in the baseline data for Brian and Ethan. For each small group discussion session, I provided each student (participants and non-participants) with a focused issue on a 4” x 6” card. I asked each small group to designate a recorder and a timekeeper. The recorder in each small group was responsible for the following: (a) pick up an audio recorder located at the front of the classroom; (b) turn on the recording device and record the date and time, and say their pseudonyms; (c) at the start of the discussion, start with recording the month, day, year, and the start time; (d) at the end of the discussion, end with

saying “End of recording” and turn off the device; and (e) return the device to me. The timekeeper designated 15 min to discuss the problem and provided action steps.

My roles in the classroom during the small group discussions included: (a) walking around and monitoring students by listening to their dialogic discourse, (b) answering any clarifying questions about the focused issue or small group procedures, and (c) reviewing protocols for audio recording (e.g., picking up and returning the audio recorder and reminding student designees for saying date, time, and “start recording” and “end recording”). When the audio-recording devices were collected, I removed the Universal Serial Bus (USB) from each device and uploaded the recording into a password-protected Dropbox folder on my laptop. All students used pseudonyms during small group discussions, so no identifiers were gathered. Next, I uploaded the recording to Temi for transcription services. Once the transcription was available, I downloaded it to the university computer and then uploaded it to my university Dropbox folder. I listened to the recordings to check that pseudonyms were used. Any real names accidentally spoken were replaced with pseudonyms before data analysis.

Baseline

During the baseline condition, I followed the steps described under the General Procedures above. I randomly selected a focused issue for each session using Google’s Random Number Generator App. Students in each group (i.e., Group 1, Group 2, and Group 3) were engaged in the small group discussion at their designated table and room. They participated in small group discussions by responding to the problem in the scenario. My roles were limited to those described under the General Procedures section. Students’ roles were to respond to each other’s opinions and perspectives.

Training

Prior to a participant entering into the STH condition, I provided the STH training to the intervention group, which included one or two participants and the non-participants in the same group. At the beginning of the training, I pulled the intervention group to the conference room upstairs and provided an overview of the STH method, definition, and example of what each Thinking Hat represents. We practiced the behavioral characteristics of each hat with a focus issue, and I had students share their thoughts through each Hat (see Appendix E). After we briefly practiced, I provided the same focused issue other groups used for that day to practice the STH method. After we completed the discussion, I asked the students if they had any clarifying questions. During the 30 min of training with the intervention group, the course instructor and the remaining groups were in the adjacent class gathering baseline data.

STH Intervention

During the STH condition, I pulled the intervention group to the conference room away from the other group(s), which continued the baseline in the classroom. First, I briefly reviewed each Thinking Hat and then explained that I would assume the role of the Blue Hat to set up the goals, summarize, and end the session. Secondly, I designated a timekeeper and an audio recorder for the intervention session. Once the recorder was turned on, we took turns saying our pseudonyms. Then a volunteer read aloud the focused issue. Next, we sequenced the Hats based on the group's consensus. Then, I facilitated as a Blue Hat wearer to encourage the students to share their response to the focused issue through the lens of the designated Hat. As a Blue Hat wearer, I made sure that all students participated through each specific Hat. If any student spoke in a different Hat, I clarified and redirected them to think differently using the assigned Hat. The total time designated for the STH method was 20 min.

During the first intervention session with Eliza, I recognized that she did not contribute to the Green Hat thinking, so I modified the procedure to include a 30-s think time for the second intervention session. When Eliza contributed to the Green Hat thinking after the 30-s think time, I proceeded with the modified procedure to include the think time at the third intervention session. I gathered three intervention data points using the think time. For Ender's intervention, I followed the same procedure I used for Eliza's first intervention and then I implemented the modified procedure with think time for three sessions. Then with the remaining two students (i.e., Brian and Lori), I used the modified procedure across three sessions.

Maintenance

When a participant met the mastery criterion (i.e., using at least four thinking Hats in a discussion for three consecutive sessions), the participant and their assigned small group members entered the maintenance phase and engaged in small group discussions using the focused issues. The maintenance condition followed the same procedures as the baseline condition and also told students that anyone could choose to wear the Blue Hat during this condition.

Procedural Fidelity

The course instructor and a special education doctoral student provided procedural fidelity data for at least 33% of sessions across experimental conditions using procedural fidelity checklists (Ledford & Gast, 2018). The procedural fidelity checklists for the baseline/maintenance contained the same procedure regarding the starting and ending the recording time, date, time, and pseudonyms, as well as my roles in supporting the groups. The course instructor completed the baseline/maintenance checklist during these phases. The checklist consisted of five steps, which included handing out the focused issues cards,

procedures for recording, asking for clarifying questions, and asking students to pick up the folders, audio recorder, and start the discussion (see Appendix G).

The STH training checklist contained 20 steps of teaching behavior that consisted of communicating the definition of the Hats, benefits, and the descriptions of each Hat; providing a sample focused issue to practice the Hats; and using the focused issue to engage the group in discussions (see Appendix E). The checklist for the intervention condition included 10 steps, which was similar to the training session except that it did not include a practice session (Appendix K). I calculated the procedural fidelity by dividing the number of correct steps by the total number of applicable steps and then multiplied it by 100.

Data Analysis

Single-Case Multiple Baseline Design

I used visual analysis and descriptive data to observe the trends, variability, level, and consistency across phases (Ledford & Gast, 2018). Trends refer to the direction of the data points over time, indicating whether there is directional change in the dependent variable. Variability describes the fluctuation of the data points or range, showing how much the data points differ from one another. Level refers to the amount of behavior that occurs and the mean score for the data within a phase, reflecting the overall magnitude or position of the data on the graph (Kennedy, 2005; Kratochwill et al., 2010). Lastly, consistency involves the degree to which data patterns are stable across conditions or phases, demonstrating the reliability of the observed effects. I also examined if there were demonstrations of effects at three points in time to determine if a functional relation existed between the STH and the dependent variables. I graphed and analyzed each of the four dependent variables to answer the first four research questions.

Thematic Analysis

I used a thematic analysis approach (Braun & Clarke, 2006), an inductive process in which the researcher identifies themes as revealed in the interview data, to answer Research Question 5 (Creswell & Poth, 2018; see Appendix Q). First, I familiarized myself with the interview data by reading the transcriptions to familiarize myself with the content and jotting down notes in the margins of the transcriptions (Merriam & Tisdell, 2016). Next, after this initial data review, I determined initial codes based on the data by either directly taking the unit (i.e., in vivo codes) or summarizing a unit directly from the participants' words (Appendix Q; Saldaña, 2021).

After completing an organized list of the initial codes (see Appendix Q) on my university-secured Google spreadsheet, I met with my two secondary coders to review the codes and some sample texts to clarify them (Sauder & Gilson, 2023; see Figure 3). Some data were double-coded because they could be categorized in multiple ways due to the complexity of students' responses. Each secondary coder reviewed 50 % of my coding for agreement, and after resolving the discrepancy (see Figure 4 for an example), we generated a total of 133 initial codes.

Figure 3

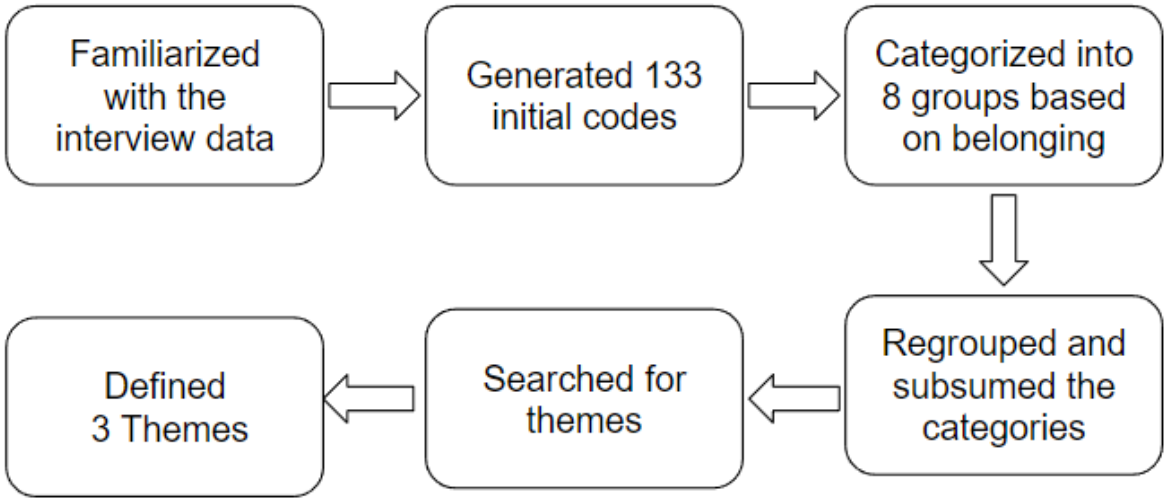
STH Coding Check

Participant Name	Participant Data	Initial codes	Coder 3 (Agree/ Disagree)	Coder 3 Comment	Coder 1 Comment
Brian	I had a great time with these six thinking hats and that experience **it allowed me to think in different ways** and **thinking different perspectives**, which I thought was very cool. I think a lot of times **we think one way or we think in one hat and we stick to that**, but it's **allowed me to broaden up** and **speak in different ways** and **think in different ways**, which I think was helpful. So I overall **enjoyed** that experience.	11. allowed me to thinking different perspectives 12. before hats, we think one way or in one hat and stick to it 13. broaden up 14. speak in different ways 15. think in different ways 16. enjoyed the experience	Disagree	My additions are in bold.	I can see why you highlighted those words. I included the describing words as units. 125. a great time 126 very cool 127. helpful

Next, I grouped and subsumed these codes by belonging and similarities, which led to eight categories confirmed by the coders: (a) thinking about their own thinking processes, (b) thinking about how the group is thinking, (c) engaging in diverse perspectives, (d) participating actively during small group, (e) solving daily problems, (f) solving problems related to school, (g) positive experiences with the STH, and (h) enhancing creative thinking (see Appendix Q). Three broad themes were then drawn from the regrouping and subsuming of the initial codes and categories. For the thematic coding process, see Figure 4.

Figure 4

STH Coding Process



Potential Threats to Validity

I took multiple measures to minimize potential threats to internal validity (Slocum et al., 2022). Given that the honors students self-nominate to participate in the EHP, generally feel the pressure to do well as part of the study (Dixon et al., 2016; Hensfield et al., 2014; Lee et al., 2021) and demonstrate teacher-pleasing behavior (Coleman & Shah-Coltrane, 2011a; 2011b; Harradine et al., 2014), the Hawthorne Effect or their tendency to strive for perceived desirable behaviors was likely, making the baseline data unstable. I explained at the beginning of the study that participating in the study has no positive or negative effect on their grades for the course work. Another way I tried to minimize the Hawthorne effect was to include the audio recording procedure before the baseline to help students become accustomed to and familiar with the setup of the materials and procedures.

To avoid the attrition bias for the third and fourth participants, who received the intervention after session 20, which was about 2 months later than the first participant, I ensured

that the baseline data involved limited aversion (Ledford & Gast, 2018). For example, my procedural script included reminding the small groups of the significance of this research in honors curricula and its lasting effects and shared my appreciation for persevering through this study. Moreover, the students' confidence or "therapeutic trend" (Ledford & Gast, 2018, p. 243) could occur if the content of the course included any strategies related to the STH method. To avoid the history threat, I attended every class session from the beginning to the end and observed that the instructor's teaching did not mention the STH. Additionally, to avoid maturation, the course instructor and I reviewed the course schedule and previewed the lessons on a weekly basis to ensure that there was no overlap between my research study and the course content. Lastly, the participants' personal desire to learn more about the STH method outside of class could have influenced the data during the baseline phase. To prevent the upward trends of the baseline group, I clearly stated at the beginning of the introduction to the research study that the method used for the intervention should not be shared. I also explained to the students that the result of the study would have an implication for developing university honors curricula and that their integrity and ethical commitment will positively impact honors faculty and instructors across the states.

Transparency in Qualitative Analysis

To establish trustworthiness for the fifth research question, the second coder and I frequently revisited the reflexivity statements to ensure coding and thematic analysis processes were not influenced by our assumptions, experiences, and fraudulent interpretations (Merriam & Tisdell, 2016). Further, we used analytic and methods memos as "the living codebook" (Reyes et al., 2021, p. 90) by documenting my thinking process (Merriam & Tisdell, 2016; see Appendix N). For instance, for the analytic memo, my example included how Brian's definition of

participation went beyond verbal expressions (see Appendix P). I recorded that his understanding of active participation equated to his own listening behavior. For the methods memo, I jotted down that setting aside the coding process and returning a week later refreshed my understanding of how some codes should be subsumed or regrouped to draw out nuanced themes.

CHAPTER 4: RESULTS

This chapter addresses results for each research question. I first reported interobserver agreement (IOA) and procedural fidelity and then presented results for the five research questions. I reported the results using line graphs of the three dependent variables (i.e., total number of perspectives, counted as the number of Hats; topic-related participation units; and creative ideas). Then I used bar graphs to illustrate the results for the fourth dependent variable, (i.e., total number of words per Hat). This section contains the description of the changes in level, trend, and variability of the four dependent variables. Lastly, I reported my social validity findings of the university's honors students' interview data through thematic analysis.

Interobserver Agreement

Observations of each session for Eliza, Ender, Brian, and Lori were recorded and transcribed to examine the data for the four dependent variables (i.e., the total count of perspectives counted as Hats, total count of on-topic participation, total count of creative ideas, and total count of words per Hat). A second rater scored the transcriptions independently for 30% for baseline, intervention and maintenance. The IOA for the number of Hats ranged from 65% to 100%, with a mean of 72%. After the second coder and I met to resolve disagreements, we reached 100% agreement. The mean IOA for the number of on-topic participation units was 90% (range 80%–100%). After resolving disagreements, we reached 100% agreement. The IOA for the total count of creative ideas was 95% (range 90%–100%). The IOA for the number of words per Hat ranged from 45% to 100%, with a mean of 66%. After meeting to resolve discrepancies, we reached 100% agreement.

Procedural Fidelity

Observation for training, baseline/maintenance, and intervention behavior was recorded to examine my behavior. Two second coders scored 100% of sessions. Procedural fidelity for the baseline/maintenance observation was 100%; the training and intervention behavior was 90% (range 88%–100%).

Total Count of Perspectives (i.e., Thinking Hats)

Eliza

During the baseline phase, Eliza's performance on the multiple perspectives (i.e., number of Thinking Hats) demonstrated a mean of 1.57 (range 1–3), with moderate variability, and no consistent trend across the seven sessions. This indicates a relatively stable performance. During the first intervention session, Eliza produced four Hats with no Green Hat ideas. In response to this observation, I modified the procedure to include a 30-s think time for the small group. This modification led to her consistent use of at least five Hats, achieving a mean of 5.33 (range 5–6) across the next three sessions. In the maintenance phase, spanning across the 11 sessions, Eliza's use of Thinking Hats showed a mean of 4.27 (range 3–6), indicating an overall increasing trend and a higher level of variability compared to her baseline performance. During session 22, I introduced a procedural modification during the whole group instruction to emphasize the importance of the Blue Hat role and everyone's contribution of five Hats. This modification likely contributed to Eliza's use of six Hats during that session.

Ender

Ender's performance on the multiple perspectives demonstrated a stable pattern with a mean of 2.5 (range 2–3) across 13 sessions, indicating no clear trend or variability. During the first intervention session, Ender used five Hats with no Yellow Hat ideas. During the following

intervention session, I modified the procedure, asked him for a Yellow Hat contribution, and included a 30-s think time. This modification resulted in Ender meeting the mastery criteria, achieving a mean of 5 (range 4–6) across three intervention sessions, with an overall increasing trend. Due to five absences, Ender had limited data points during the maintenance phase. However, in the two recorded maintenance sessions, Ender consistently produced all six Hats, indicating potential for sustained use of the STH method.

Brian

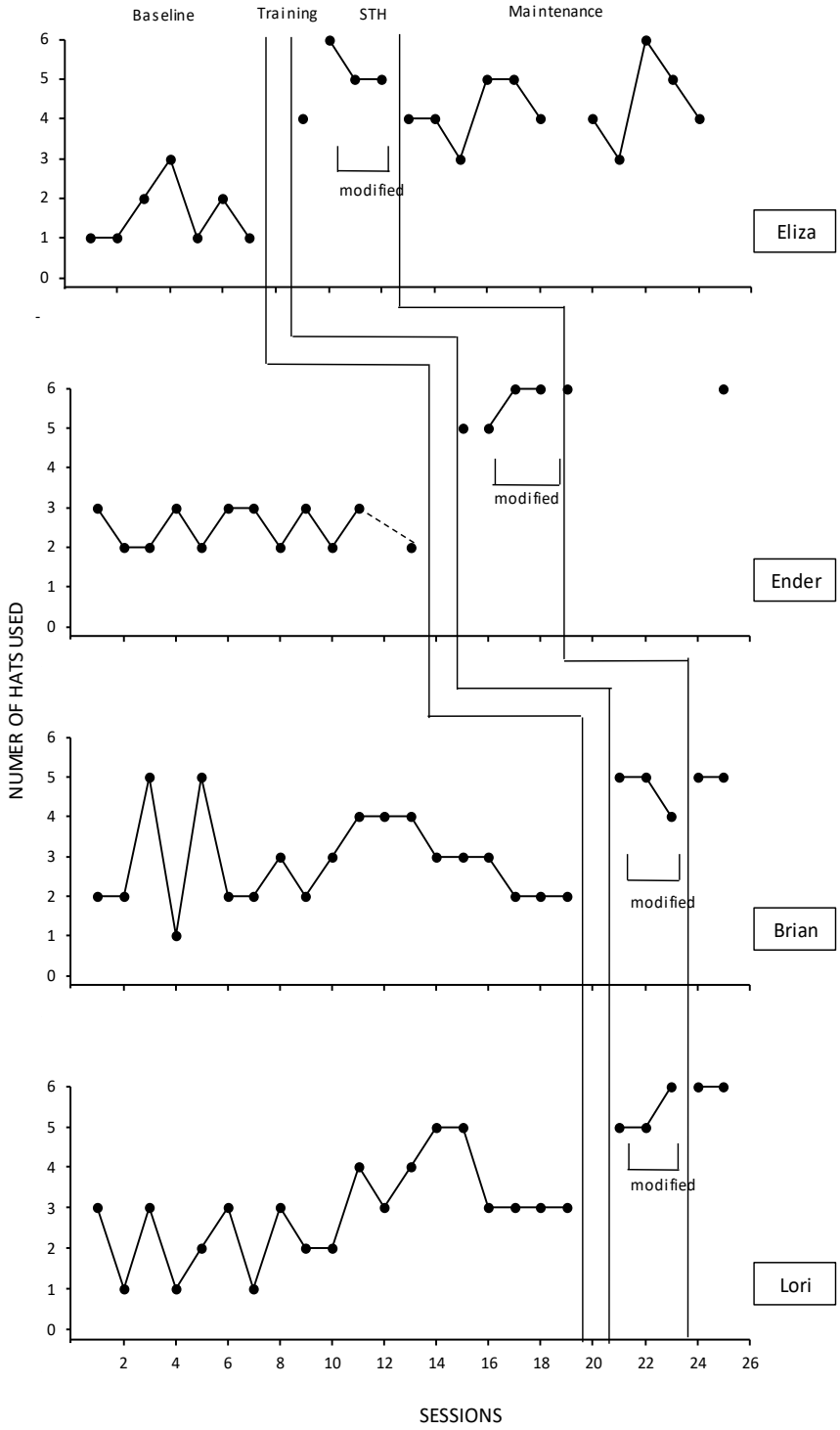
Brian's baseline performance on the number of Hats was highly variable, with an overall mean of 2.74 (range 1–5) across 19 sessions. Despite an upward trend between sessions 4 and 11, Brian's baseline data showed a downward trend thereafter, stabilizing at two Hats across the last three sessions. During the STH intervention, Brian immediately produced five Hats for two sessions, followed by four Hats during the third session, resulting in a mean of 4.67 (range 4–5) and meeting the mastery criterion. In the maintenance phase across two sessions, Brian's performance remained stable, consistently producing five Hats in both sessions.

Lori

During the baseline phase, Lori's performance on the number of Hats showed variability, with an overall mean of 2.8 (range 1–5) across 19 sessions. An upward trend was observed between sessions 9 and 15, after which her performance stabilized at three Hats for the last four sessions of the baseline phase. Following the STH training, Lori demonstrated consistent improvement. During the intervention phase, she produced five or more Hats across three sessions (mean = 5.33, range 5–6). In the maintenance phase, Lori's performance was stable, producing all six Hats in both sessions.

Figure 5

Total Count of Six Thinking Hats



Total Count of Topic-Related Participation Units

Eliza

During baseline, Eliza's performance on the topic-related participation units showed a mean of 3.14 (range 1–7), with moderate variability and a slight downward trend across the seven sessions. During the three intervention sessions with the modified STH procedure of additional think time, Eliza achieved a mean of 7.33 (range 6–9) with a very slight decreasing trend, indicating a positive response to the intervention. In the maintenance phase across 11 sessions, Eliza's on-topic participation units showed a mean of 7.82 (range 5–13) with a high level of variability and no clear trend. During the whole group instruction in session 18, I modified the procedure to include the importance of the Blue Hat role and everyone's contribution of five Hats to the whole group, which might have contributed to Eliza's increase in participation in session 18.

Ender

During the baseline phase, Ender's performance on the on-topic participation units showed a mean of 5.54 (range 4–9), with an overall low level of variability and a slight downward trend across the 11 sessions. During the three intervention sessions with the modified STH procedure of additional think time, Ender produced a mean of 11.33 (range 8–14) with a steep increasing trend and high stability. In the maintenance phase, across two sessions with six sessions apart, his participation units showed a mean of 13 (range 12–14).

Brian

During baseline, Brian's performance on the on-topic participation units showed a mean of 7.05 (range 2–15) with high variability and a downward trend across the last four sessions. During the three intervention sessions, Brian showed a mean of 6 (range 5–8), with an overall

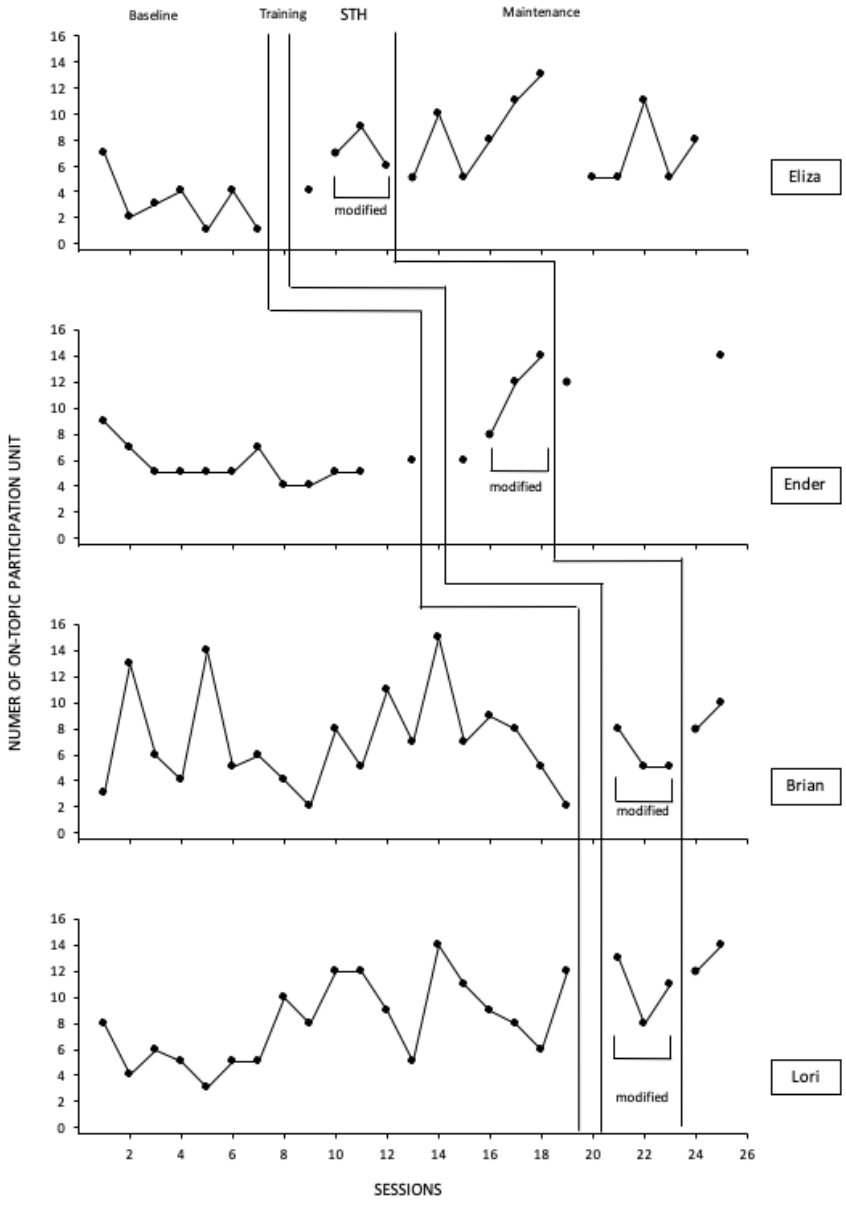
decreasing trend, suggesting no positive effects. In the maintenance phase across two consecutive sessions, Brian's participation units showed a mean of 9 (range 8–10) with an overall upward trend.

Lori

During the baseline phase, Lori's performance on the on-topic participation units showed a mean of 8.05 (range 3–14) with high variability and an increasing trend across the 19 sessions. This indicates an inconsistent performance with significant fluctuations in participation. During the three intervention sessions, Lori showed a mean of 10.67 (range 8–13) with moderate variability and an overall decreasing trend. In the maintenance phase, spanning two consecutive sessions, Lori's on-topic participation showed a mean of 13 (range 12–14) with an overall increasing trend.

Figure 6

Total Count of Topic-Related Participation Units



Total Number of Creative Ideas

Eliza

During baseline, Eliza did not produce any creative ideas (i.e., Green Hat) across the seven sessions. After receiving training on STH, Eliza still did not use Green Hat during the first intervention session. After being provided with think time (i.e., modified procedure), she produced one creative idea per session across three consecutive sessions. In the maintenance phase across the 11 maintenance sessions, Eliza's creative ideas showed a mean of 0.82 (range 0–2) with an overall downward trend. During the 11 maintenance sessions, she generated at least one creative idea across eight sessions.

Ender

Ender's performance during the baseline phase on creative ideas showed a mean of 0.18 (range 0–1). He consistently produced zero creative ideas except for session 6 and session 10 when he generated one creative idea. During the first STH intervention session, Ender generated one creative idea, followed by one or two ideas across three intervention sessions during the modified procedure phase, with a mean of 1.67 (range 1–2). Ender generated one creative idea consistently during each of the two maintenance sessions.

Brian

Brian's baseline phase on the total number of creative ideas showed a mean of 0.47 (range 0–3). Of the 19 baseline sessions, Brian generated zero creative ideas during 13 sessions, one idea during five sessions, and three ideas during session 16. Except for the outlier during session 16, his baseline data path was generally stable. During the three intervention sessions, Brian consistently produced one creative idea. He also consistently generated one creative idea during each of the two maintenance sessions.

Lori

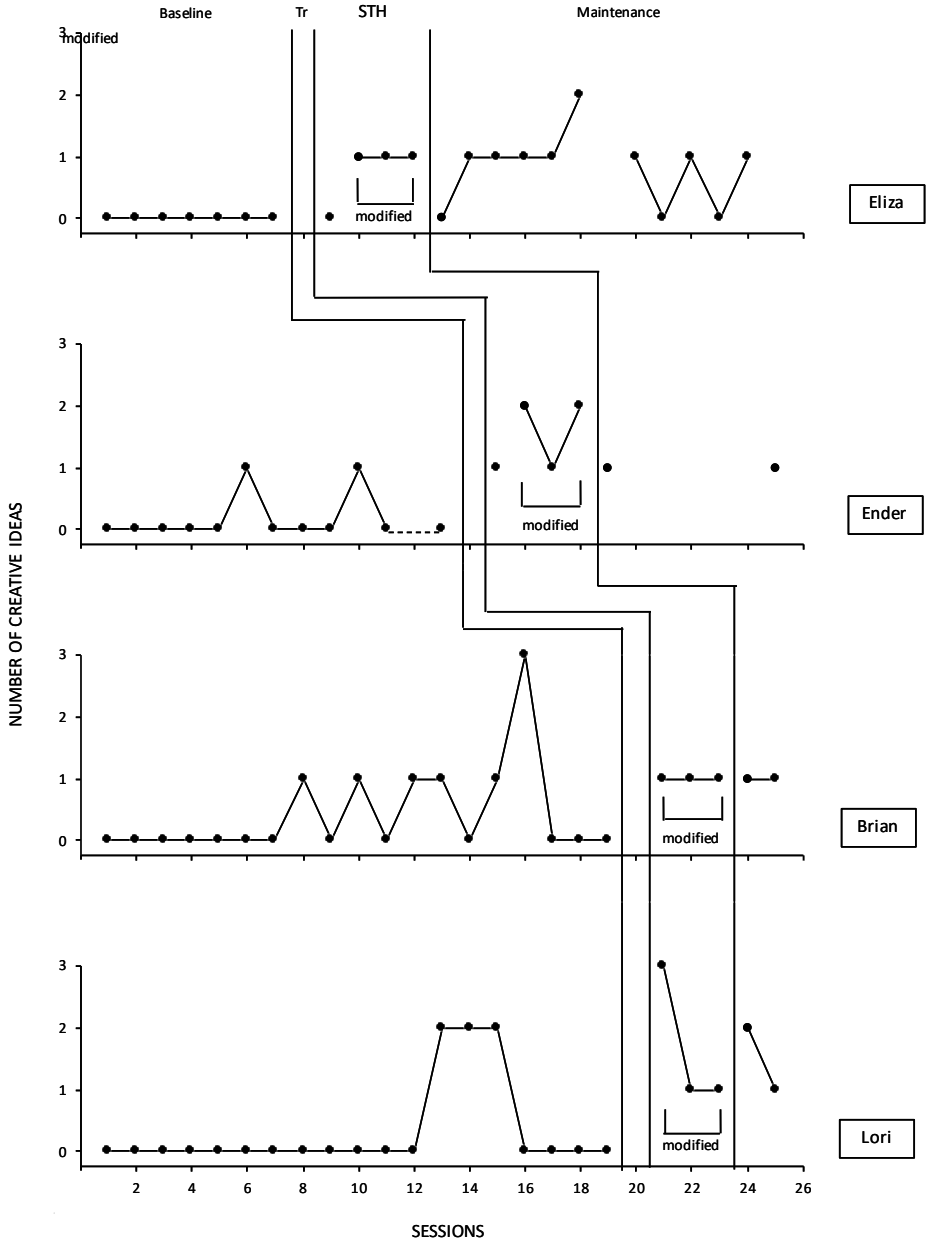
During the baseline phase, Lori's performance on the total number of creative ideas showed a mean 0.33 (range 0–2), with no clear trend across the 19 sessions. Except for three sessions (sessions 13–15) during which she generated two creative ideas, Lori did not use the Green Hat during other baseline sessions. During the three intervention sessions, Lori generated at least one creative idea with a mean of 1.67 (range 1–3) and a decreasing trend. During the two maintenance sessions, she continued to generate at least one creative idea.

Summary

Although no functional relation could be established, the overall result demonstrated improvement in producing at least one creative output for the participants (see Figure 7). Modified instruction with additional 30-sec think time allowed all participants to express at least one alternative idea about the issue discussed in small groups; however, except for Eliza, whose behavioral change from baseline to three intervention session demonstrated behavior changes, Ethan, Brian, and Lori had an overlap of data between baseline and interventions.

Figure 7

Total Count of Creative Ideas



Total Number of Words Per Hat

Eliza

During the baseline condition, Eliza produced the most words using Black Hat (mean = 150.14 words, range = 0-643 words), followed by the use of White Hat (mean = 31.14, range = 0-137), and then Yellow Hat (mean = .43, range = 0–2). During the STH phase, Eliza's mean number of words was the highest for the Green Hat (mean = 64.67, range = 30–130), followed by the Yellow Hat (mean = 60, range = 29–91), the Black Hat (mean = 46.33, range = 42–54), and the White Hat (mean = 43.67, range = 25–62). She also produced some but minimal words for the Red Hat and the Blue Hat. During the maintenance phase, Eliza continued to use all Hats with most words in the Black Hat (mean = 64.33 (range 42–54), followed by the Green Hat (mean = 64.67, range 30–130), the Yellow Hat (mean = 50.36, range 0–134), the White Hat (mean=43.67, range = 25–62), and the Blue Hat (mean = 2.33, range 0–7).

Ender

During the baseline condition, Ender produced the most words using the Black Hat (mean =187.25 words, range 0–419 words), followed by the use of the Yellow Hat (mean = 72.63, range 0–475), the White Hat (mean = 63.38, range 0–153), the Green Hat (mean =14.75, range 0–68), and then the Blue Hat (mean = 8.75, range 0–52). Ender did not use any Red Hat in baseline. During the STH phase, Ender's mean number of words was the highest for the Black Hat (mean = 234.5, range=123–352), followed by the Green Hat (mean = 85.25, range 0–127), White Hat (mean = 73.25, range 52–92), Yellow Hat (mean = 42, range 0–105), the Blue Hat (mean = 10.25, range 0–30), and the Red Hat (mean = 2, range 1–3). During the maintenance phase, Ender continued to use most words in the Black Hat (mean = 127, range 0–463), followed by the White Hat (mean = 97.67, range 0–150), the Red Hat (mean 0 = 4, range

0–11), the Green Hat (mean = 67.67, range 0–116), the Yellow Hat (mean = 36.71, range 0–105), and Blue Hat (mean = 19.86, range 0–46).

Brian

During the baseline condition, Brian produced the most words using the Black Hat (mean = 42.67 words, range = 0–269 words), followed by the Green Hat (mean = 14.67, range 0–40), the White Hat (mean = 12.75, range = 0–89), the Yellow Hat (mean = 12.75, range = 0–89), the Blue Hat (mean = 8.5, range = 0–63), and the Red Hat (mean = 4.5, range = 0–35). The baseline data indicated high variability and no clear trend. The baseline data indicated high variability and no clear trend. During the STH phase, Brian's mean number of words was the highest for the Green Hat (mean = 25, range 0–63), followed by the White Hat (mean = 22.67, range 0–42), the Black Hat (mean = 21.67, range 4–36), the Blue Hat (mean = 20, range 0–30), and then the Red Hat (mean=17.67, range 4–38). This indicates an increased number of words across multiple hats with moderate variability. In the maintenance phase, Brian continued to use most words in the Black Hat (mean=72, range 68–76), the Green Hat (mean = 43.5, range 17–70), the White Hat (mean = 29; range 11–47), the Blue Hat (mean = 14.5, range 7–22), and the Red Hat (mean = 6, range 5–7).

Lori

The baseline phase demonstrated the total number of words per hat as follows: White Hat with a mean of 122.38 (range 4–346), Red Hat with a mean of 1.77 (range 0–16), Yellow Hat with a mean of 85.38 (range 0–274), Black Hat with a mean of 164.77 (range 43–365), Green Hat with a mean of 13.38 (range 0–47), and Blue Hat with a mean of 60.33 (range 0–1513). The baseline data indicated Lori used all Hats with the Black Hat being most frequently used during the 19 sessions. During the three intervention sessions, Lori's performance demonstrated the

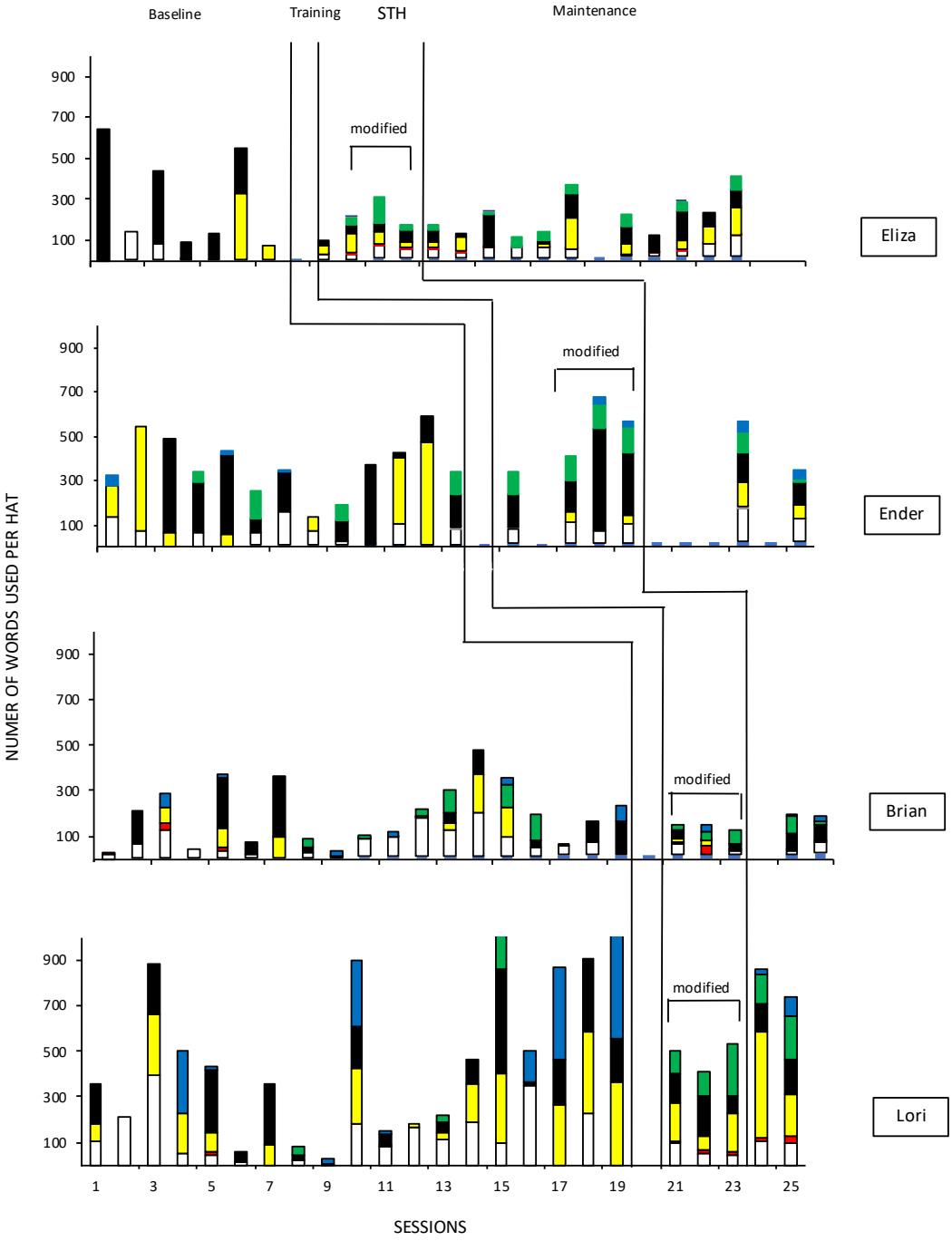
following means and ranges in all six Hats: White Hat had a mean of 62.67 (range 41–95), Red Hat had a mean of 12.33 (range 8–15), Yellow Hat had a mean of 133 (range 64–169), Black Hat had a mean of 128.67 (range 77–175), Green Hat had a mean of 143 (range 97–230), and Blue Hat had a mean of 133.67 (range 27–405). This indicated an increase in the number of words for the Red, Yellow, Green, and Blue Hats. In the maintenance phase, Lori showed the following means and ranges across six Hats: Yellow Hat had the highest mean of 221.75 (range 64–468) and then Green Hat had a mean of 112 (range 65–191). Black Hat had a mean of 90.5 (range 125–155), White Hat had a mean of 64.5 (range 41–107), Red Hat had a mean of 15.25 (range 8–29), and Blue Hat had a mean of 36 (range 7–90). Lori greatly increased her use of Yellow Hat during the maintenance condition.

Summary

No functional relation could be established between the STH and the number of words per Hat and the behavioral change between baseline and intervention and maintenance were highly variable and unstable (see Figure 6). Except for Ender whose use of Black Hat words increased during the STH phase, Eliza, Brian, and Lori's thinking behavior changed from Black Hat to Green Hat. During maintenance phase, Lori and Brian continued in their thinking behavior in Green Hat. On the other hand, Lori's STH intervention did not sustain through maintenance but changed to Yellow Hat as having the highest mean number of words while Ender maintained the Black Hat as the highest mean number of words.

Figure 8

Total Count of Words Per Hat



Note. Lori's total count of Blue Hat words for session 19 was 1,513.

Social Validity Findings

Three themes related to the social validity of the intervention were drawn from the interview data as shared by the four university honors students who are introverted: (a) awareness of the discussion behavior, (b) meaningfulness of the STH method, and (c) application to problem-solving situations.

Theme 1: Awareness of the Discussion Behavior

Awareness of Metacognitive Processes. In response to Research Question 5, this theme revealed how the STH method increased the introverted honor students' awareness of their own cognitive processes, or metacognition (Flavell, 1979). For example, the training and intervention allowed them to change how they used to think about issues or topics during baseline. The method " . . . challenged our preconceived ideas of what we . . . were thinking" (Eliza) and that specific Hats allowed them to direct their thinking: "I had spontaneous comments to make. . . [but] should I say that right now 'cause that doesn't fit into the [yellow] hat" (Lori). Additionally, instead of merely contributing creative ideas, they were able to think about ". . . how [they are] being creative" (Brian). These quotes reveal that the STH intervention pushed the introverted honors students to ponder, question, and wrestle with their own strongly held beliefs and ways of thinking about their perceptions of themselves and other relevant issues in small group settings.

Moreover, the data also revealed that the six specific behavioral characteristics of each Hat represented by colors allowed the introverted students to control and maneuver their thinking processes. Like Lori's example above, students felt challenged to think in specific directions because each Hat represented its own behavioral characteristics. Ender, who shared that he felt most comfortable in Black Hat thinking described that "Green hat . . . instead of . . . immediately

shutting things down[,] let's just talk about possible solutions, even if overall they might not be the best." Despite his tendency to lean towards the Black Hat (i.e., critical and logical ideas with justification), he understood how to think in the Green Hat (i.e., creative or alternative ideas without justification). Similarly, Lori expressed what happened during the yellow hat conversion, "I wouldn't automatically respond maybe with something negative or . . . [say] . . . that's not a good idea." Further, the structure of the Hat also allowed the students to perceive how they interacted with their peers.

Awareness of Group Interaction Processes. The introverted honors students also perceived the STH method as a collaborative endeavor integral to discussion behavior. They viewed the intervention as improving the verbal behaviors of the entire group, including opportunities to participate, respond, and provide solutions to the problems. For example, Eliza recognized how the quality of group discussion improved after the intervention, "It was . . . easy at first to get sidetracked. . . so the hats . . . brought it back every time". Attributing the hats *as a person through personification* provides insight into the intervention to change a group's behavior.

Students also felt that the STH allowed them to appreciate peers' contributions during small group discussions. First, they noted that ". . . people felt comfortable with sharing and knowing" (Lori) in specific hat thinking time because all students were thinking in the same direction. Secondly, the STH method allowed them to ". . . know more about the problem in some instances because some of us had more information sometimes, like we'd get through and realize we had . . . other information . . . ." (Ender). The method allowed students to feel safe and perceive how their peers can be part of solving problems as a collective process.

Engaged in Diverse Perspectives. The university honors students viewed the STH method as a tool to engage in diverse perspectives. The codes that belonged to this sub-theme

used action verbs to describe how their discussion behavior changed over time. The students mentioned how the STH (i.e., forces you to look at things differently; [challenges you] to see good things; and [interacts] with the perspectives). In addition to gaining diverse perspectives from interacting with their peers, they became more knowledgeable of the issue or the idea they did not have at the start of the discussion. The Hat conversation moved their thinking forward through listening, interacting, and sharing ideas with their peers.

Engaged in Verbal Participation. Similarly, another discussion behavior students perceived through the STH intervention was the value of verbal participation during small groups. They perceived Hats as a way to provide a safe space for them to express their ideas: "Green hat . . . instead of . . . shutting things down, being able to . . . talk about . . . possible solutions, even if overall they might not be the best" (Ender). Ender elaborated on how each Hat provided access for students to articulate and express their ideas without feeling judged. Additionally, the students perceived the designated time for each Hat as an opportunity to verbally express their ideas: "I am not a talkative person in the first place. But it gave me the opportunity to talk in different hats." (Brian). Although Brian mentioned that he would prefer to listen to others more than talking, he felt comfortable verbally participating during the intervention.

Theme 2: Meaningfulness of the STH Method

Addressing Research Question 5, this theme demonstrated the perceived meaningfulness of the STH method as experienced by the participants. They also perceived engaging in the STH method as positive and meaningful. Some descriptive codes expressing optimism about the intervention using the STH method (i.e., *great time*; *very cool*; *helpful*), were used repeatedly throughout the data from all four participants. Even though these high-achieving, introverted students prefer to work independently and choose to listen than to verbally participate, they

"enjoyed that experience" of "[broadening] up and speak in different ways and think in different ways" (Brian).

Meaningfulness of the STH method was also connected to the challenges the students faced because of their personality or personal preferences. Students perceived that the challenge of using all Hats equitably stemmed from their personality or personal interests. For instance, students shared how they were challenged by the use of the Yellow and the Red Hat. According to Ender, ". . . the Yellow Hat was probably the hardest because there were some things that I don't know what to pick up positively about this." Since Ender described himself as someone who prefers to view ideas or issues that require improvement, he was not accustomed to considering values and optimistic perspectives of an issue or an idea. Another example was Eliza's struggle to express her Red Hat ideas (i.e., gut reaction or feelings) when she was not interested in the focused issue: "I wasn't super personally connected to the topics, and so I really didn't feel any sort of way."

Benefits of the Green Hat. The honors students perceived the Green Hat as an opportunity to express their divergent ideas. Since the Green Hat allowed students to generate alternative ideas while suspending their critical lens and logical thinking, it allowed students to be more creative. Lori shared, "I think . . . the green hat . . . helped a lot because it just gives students permission to say whatever they want and not feel like . . . they [don't] have to justify their creative solutions . . . ." Eliza also described the Green Hat behavior as: "not putting away ideas that I like would normally think are . . . not realistic . . . . To kind of just open the floor for whatever wants to be said, even if it doesn't quite make sense . . . . [It's] still a valuable response." Moreover, they perceived the green Hat as part of action to move forward with an action plan or solutions: "[the Green Hat was helpful] . . . . now that . . . you've talked about [other perspectives], like what could you possibly do about it?" (Ender).

Theme 3: Application to Problem-Solving Situations

The third theme illustrated how students apply the STH method to various problem-solving situations beyond the classroom setting, which is directly related to the findings for the Research Question 5. Adding onto the meaningfulness of the STH method, the honors students perceived the method as a practical utility to solving problems in the context of their academic majors and school experiences. The examples the honors students provided regarding how they could use the STH method was proximal to their current circumstances as university students. How the STH method could be useful in other contexts included problem solving situations related to group projects, classroom assignments, major-related tasks, or summer plans. Ender expressed that there is greater demand for group projects as a junior in the honors program and that the STH "might be helpful with group projects because . . . I'm starting to have to do more group projects as I'm getting farther in my major". Moreover, Lori pondered how the STH could be used to decide a course of action such as, "the positives … the negatives… [and] how am I feeling about this internship?" She also used examples of critical thinking scenarios in classes and articulated how she could use the STH in "lots of gray areas in [the field of my study]" as she thinks about potential situations that require multiple perspectives. Examples that students shared about how they think they could use outside of school were still connected to their academic interests, majors, and experiences.

CHAPTER 5. DISCUSSION

This study investigated the effects of the STH, a parallel thinking tool, on creative problem solving among four introverted university honors students. I used a single-case baseline across participants design (Cooper et al., 2020; Gast & Ledford, 2018) to determine the impact of the intervention on students' creative problem solving and participation in small group settings. In this study, I investigated creative problem solving, a broad framework that allows students to pursue real-world problems through systematic inquiries and creative thinking tools.

Using the STH method as an intervention, I measured the framework through the four variables (i.e., total number of perspectives counted as Hats; total number of topic-related participation; total number of creative thinking; and the number of words per Hat). Quantitative results demonstrated a functional or causal relation between the STH method and the total number of perspectives as counted by the number of Hats. The introverted honors students maintained at least four to five perspectives after they completed intervention. Although no functional relation existed between the STH and the other three dependent variables (i.e., topic-related participation units; the number of creative ideas; and the number of words per Hat), the study revealed insight on how to promote creative problem solving in honors students. Further, the participants' interview data indicated the significance and meaningfulness of the intervention, which added value to this study. In the following sections, I present my discussion points organized by the five research questions. Then I elaborated on contributions, limitations, suggestions for future research, and implications for practice.

Research Question 1: To what extent will the STH method increase the total number of perspectives, counted by the number of Thinking Hats, shared by university honors students during small group discussions?

Results of the participants' number of Hats across the conditions showed that the STH method effectively challenged the students to view focused issues from multiple perspectives. All four students demonstrated an immediate increase in the number of their different perspectives during intervention and successfully reached mastery of using at least four Hats for three consecutive sessions during the STH condition and all participants continued the use of at least three Hats (Eliza) or five Hats (Ender, Brian, and Lori) during the maintenance condition. Moreover, the results demonstrated a clear functional or causal relation between the STH intervention and the introverted students' number of perspectives due to positive changes at four points in time. The immediacy of change in levels from baseline to intervention adds value to the slim literature on the STH method, as mentioned by Chien (2021) and Sternberg (2021). This important result highlights key elements of the STH that are deemed effective for promoting multiple perspectives in high-achieving university students. The positive changes may be related to the concept and structure of the STH method and the role of the facilitator.

First, the STH method provides clarity of ideas using a parallel thinking concept (de Bono, 1999; Peterson et al., 1998), as indicated by the STH instructor guide (Six Thinking Hats [STH], 2021). Each Hat represented a metaphoric pathway for thinking (de Bono, 1999) that enabled *all students* to lift up their voices in a specific direction, providing clarity and safety for them to engage six perspectives. The parallel thinking approach motivated the students to feel safe to discuss their ideas openly with those in the small group (Colangelo, 2018). Additionally, behavioral descriptions for each Hat provided easy access for students to understand and apply to

real-life scenarios. Especially for high-achieving undergraduate students who are self-directed and motivated (Calabrese & Capraro, 2021), thinking differently about situations or problems can be intellectually stimulating.

Second, the structure of the STH method provided highly motivated students to share ideas from multiple perspectives in a relatively short time (i.e., 20 min). For instance, the honors students sequenced the Hats based on the topic's relevance and determined how many minutes should be allotted per Hat before sharing their Hat perspectives. In the same way that autonomy and flexibility were some of the key motivating factors for these students to apply to the rigorous honors program (Cognard-Black & Spisak, 2019) to challenge themselves, the structure of the STH method allowed the students who did not contribute to sharing their ideas through diverse lens within a timing structure that they selected.

Third, the role of the facilitator during the intervention played a pivotal role in affecting an immediate change between the intervention and the number of perspectives. After spending 30 min training students, including practicing each Hat idea, I redirected and reviewed the Hats with the students. As a Blue Hat wearer, I also listened to allow them to fully engage in the Hats and also asked questions to the students who did not contribute an opportunity to share their ideas (i.e., What Yellow Hat ideas do you have before we move on to the next Hat?). These findings are supported by several research studies that suggest that methods for motivating high-achieving students to feel safe in the classroom include teachers actively listening to empower students to take ownership of learning (Gilson & Little, 2016; Gilson et al., 2023) and connecting with instructors or mentors with content expertise (Hebert & McBee, 2007; Hebert, 2017). Additionally, Siegle and colleagues (2013) also discovered that university honor students found motivation to be successful in their university lives because of their former teachers' expertise,

relatability, and encouragement. The researchers' qualitative analysis of a focused group of university honors students indicated the important role of a facilitator to promote multiple perspectives.

Research Question 2: To what extent will the STH method increase the number of topic-related participation units shared by university honors students during small group discussions?

The STH did not directly lead to an increase in verbal participation units for Eliza and Ender but not for Brian and Lori. Unlike the causal relation demonstrated through the total number of perspectives, the total number of topic-related participation units (i.e., a continuous verbal statement a participant expresses at a given time) did not demonstrate a functional relation to the intervention due to the lack of three demonstrations at three points in time. An important discovery was that rich and diverse perspectives may not lead to active verbal participation among introverted honors students. For example, except for Ender, who had the highest number of on-topic participation units (i.e., 12) during intervention, Eliza, Brian, and Lori had the highest number of on-topic participation units during baseline and maintenance phases. In addition, Brian's total mean count of topic-related participation units during baseline was higher than the total mean score of participation units during the intervention. In contrast, Eliza, Ender, and Lori had a range of four to six Hats on the days they had their highest number of topic-related participation units. Lastly, what can be confirmed is that the STH intervention did not negatively impact the introverted students' participation.

Fluctuating and variable participation units among the honors students can be explained by Sedlacek and Sedova's (2017) study, which revealed that open-ended discussions are highly nuanced and contextualized. Using multifactorial hierarchical regression, the authors

investigated whether open-ended discussion and collectivity caused students to increase their verbal participation. The researchers discovered that their participation units increased when students were in open-ended discussion groups and that students participated differently based on different contexts. This claim is supported by the perspectives of the honors students that the STH method helped them verbally participate more than it did before the intervention. Their examination points to the theoretical framework of Bakhtin's (1981) elaboration that dialogic discourse emerges from different voices constructed by individuals who speak from their own perspectives.

Several factors may explain the inconsistent results of the topic-related participation units among four participants. According to Mammadov (2018), high-achieving students' participation and engagement correlate with motivating factors (Mammadov, 2018). Personal interests, specific focused issues, and peer relations within each small group might have motivated each participant to participate differently (Brigandi et al., 2016; Little, 2012). According to Steenbergen-Hu and colleagues (2017), some of the research-based models in gifted education pedagogy, such as Type II enrichment from the Enrichment Triad Model (Renzulli, 1977), encourage building communication skills as an integral component of academic skills (Renzulli & Reis, 2014). Another example is the Schoolwide Enrichment Model; a framework that utilizes student interests to seek their own pathways for learning and promote creative thinking. Tapping into personal interests, preferences, and group dynamics were the fluid variables that might have influenced their participation units.

Another factor that might have contributed to the inconsistent result in participation could be the unfamiliarity of certain Hats. Since the Hats require the participants to express their ideas in specific ways (de Bono, 1999), it could have forced students to participate less or more

depending on their comfort level of the given focused issue. Further, the dynamics of the small group could have contributed to its inconsistency.

Research Question 3: To what extent will the STH method increase the number of creative ideas using the Green Hat by university honors students during small group discussions?

I counted the third dependent variable, the number of creative ideas (i.e., fluency; alternative ideas that do not require justification or rationale), by the total number of Green Hat thinking the participants shared in small groups (de Bono, 1999; Guilford, 1975). Although no functional relation existed between the intervention and creative thinking, the overall upward trend of producing at least one creative idea after the intervention sessions indicated a potentially positive relation between the intervention and creative ideas. Except for Eliza's stable trend across seven sessions in the baseline phase, the remaining data points during the intervention and maintenance phases for Ender, Brian, and Lori were highly variable. The participants produced at least one creative idea or solution to the focused issue after the training (Batley et al., 2009; Chiang & Hsu, 2017; Kaspi-Baruch, 2017). A lack of sufficient time to allow students to produce Green Hat thinking (i.e., no more than 5 min) may have contributed to low production and high variability.

After I modified the procedure to include a new step (i.e., independent thinking time prior to sharing Green Hat thinking), both Lori's and Ender's creative thinking increased. This incubation period (Poincare, 1910; Torrence, 1975; Wallas, 1926) is essential to internalizing and reflecting to generate more ideas. This supports the research that independent thinking time allows introverted students to think about potential creative ideas. A recent study by Mauroner and Zschau (2021) examined how a sample of 87 introverted and extroverted young adults engaged in different types of brainstorming through a survey. The researchers used a factorial

design to analyze the relationship between personality types and brainstorming methods. The result indicated that the introverted students' preference for hybrid brainstorming, where individual brainstorming time is provided, had a higher mean score than those of traditional group brainstorming. Regardless of the level of introversion, creative ideas can be explicitly taught (Torrence, 1972; 1977) to university honors students to build self-efficacy and increase motivation (Sawyer, 2017).

Moreover, although all the participants' total count of creative thinking trended in a positive direction, time constraints restricted students from sharing alternative ideas and solutions. Because the sequence of the Hats was timed (i.e., no more than 5 min total for each Hat), it is difficult to predict what the participants could produce with more time. We can be certain that the Green Hat's behavioral characteristics are for the group members to contribute ideas without judging others or themselves. In the same way, creative ideas also give birth through safe and nurturing environments allowing divergent ideas to take shape to resolve many issues we confront daily in and out of school systems.

The presence of Green Hat ideas counted during baseline for Ender, Brian, and Lori can be explained by Gu and colleagues (2022) that learning other creative thinking techniques such as SCAMPER and other associative thinking training enhances divergent thinking. Although the course instructor did not introduce the STH nor any of the nomenclatures related to the STH, students' learning could have influenced their abilities to think creatively especially for Brian and Lori. Further, the role of constraint in creative thinking is an area to be explored (Catarino et al., 2019; Haught-Tromp, 2017). Miller's (2018) study, which demonstrated a correlation between student engagement and creative courses in colleges and universities, discovered that students who take creative courses believe that they are creative. They also believe that the skills

obtained from the creative courses are beneficial to their careers. The research supports this study that when students are given a safe environment, they can generate at least one creative idea.

Research Questions 4: To what extent will the STH method increase the number of topic-related words per Hat shared by university honors students during small group discussions?

The last dependent variable was the total number of words per Hat. The research question was how the number of words the students spoke changed across the experimental conditions. Although there was no functional relation between the STH and the number of words, the results provided insight into the changes in the number of words in multiple Hats from baseline to intervention and from intervention to maintenance phases. These data signify that students were able to have more variation on sharing different perspectives rather than getting stuck into one type of thinking. For example, the baseline means of the Black Hats for Eliza (187.25) and Lori (164.77) declined during the intervention phases (i.e., 150). On the other hand, the Black Hat thinking for Ender and Brian increased as they were more engaged in multiple perspectives during the intervention condition when compared to the baseline condition.

Blue Hat Thinking

A noteworthy discussion related to Research Question 4 was the participants' implicit use of the Blue Hat. Among six Hats, the intervention and maintenance phases of the participants included Blue Hat ideas (i.e., leading, summarizing, and making sure that the group follows the rules [de Bono, 1999]), which were not explicitly required for them to use. For instance, during the intervention sessions, my procedure was to let students know that I would be the Blue Hat wearer; however, I shared that anyone can contribute their Blue Hat thinking as needed. Even

though I modeled Blue Hat thinking during three consecutive intervention sessions, none of the participants volunteered to be the Blue Hat wearer. Interestingly, they still contributed to Blue Hat ideas without taking the lead as designated Blue Hatters. This phenomenon is connected to Spark and colleagues' (2018) study that discovered that introverted individuals believe leadership roles were unpleasant and uncomfortable and perceive them as extroversion-oriented behavior.

I observed that the types of Blue Hat behavior differed between genders with introversion tendencies. For instance, while Lori, who was a female student, expressed Blue Hat thoughts focused on summarizing other students' views prior to sharing her own ideas, Ender's, who was male, Blue Hat behavior focused on clarifying terms or reframing questions to solicit responses from his peers. Additionally, Ender's Blue Hat behavior focused on reframing the question or asking an extended question to solicit responses from others. Although Brian's data revealed a lower Blue Hat count than Ender's, Brian also asked many clarifying questions which moved the discussion forward. A lack of empirical research on gender differences among introverted individuals (Park et al., 2020; Weisberg et al., 2011) made it difficult to interpret the behaviors of the participating students and situate the findings within the literature. However, this is a worthwhile direction for future research.

Research Question 5: What are university honors students' perspectives on the use of the STH method within and outside of the honors classroom setting?

The three themes from the inductive coding process provided a nuanced understanding of honors' students perspectives on the STH intervention, which complements the quantitative results of the single-case design and provides evidence of social validity (Ledford & Gast, 2020; Peterson, 2019; Snodgrass et al., 2018). As the first theme suggested, the study revealed how

introverted students valued engaging in small groups and became aware of the positive nature of sharing and expressing their ideas in structured learning groups. This finding supports Jung's (1917) construction of introversion as an attitude shaped by one's environment and exposures rather than as fixed attributes. Although Jung (1917) believed that introverted individuals prefer to investigate their own inner worlds rather than talking to others, he theorized that introversion becomes a dominant trait based on situations. In that light, the participants' positive experience of the STH can be a tool to support introverted students to manage and resolve issues related to critical views of themselves (Frost et al., 1990; Shaunessey et al., 2011) or perfectionistic tendencies (Cross et al., 2020).

The first theme's finding also supports the literature that metacognitive behaviors of introverted students are maximized when they are acquiring new languages (Kayaglu, 2013) and problem-solving scenarios (Young & Worrell, 2018); however, the honor students' perspectives also contradicted studies that found that metacognitive behavior is more strongly associated with conscientiousness or other personality attributes (Hu et al., 2021; Kelly & Donaldson, 2016). Further, contrary to the findings, other college students felt that any verbal engagement or active learning strategies place pressure on introverted students to participate and felt that it put pressure on themselves to participate (Green, 2018).

The findings also support the previous studies that the STH method is a thinking tool to improve psychosocial skills necessary for both school and daily lives (Schubert et al., 2022), especially for students from diverse backgrounds who face more barriers navigating academic and society systems (Sewell & Goings, 2020). Brian, who was a Black male, was the only participant who shared that he had applied the Black and Green Hat to discuss with his mom on how to efficiently pack bags for the summer vacation.

The second theme revealed that the participants found the STH as a positive tool for sharing creative ideas. Despite the cautionary interpretation of a functional relation between the STH method and creative thinking based on the results of this study, the participants' positive perspectives indicated that the Green Hat time allowed them to share alternative and novel ideas and solutions. One of the consistent findings was the students' appreciation for creative thinking (i.e., Green Hat) despite their natural tendencies to be critical thinkers (i.e., Black Hat). This theme also supports the previous research that the STH method allowed students to be more creative (Clarke et al, 2016; Engin, 2017); however, an unexpected finding included how Green Hat provided relief for participants to not must rationalize and defend the creative idea.

The third theme supported many research findings that creative thinking tools are limited to academic contexts and difficult to replicate outside of school settings. Except for Brian, all three students provided examples of school settings where the method could be applicable.

Although many studies in gifted education dominated how high-achieving students tend to be critical of themselves more so than non-high achievers (Cross et al., 2018; Mammadov et al., 218; Rinn et al., 2020), their perspectives would allow honors faculty and instructors to consider designing curriculum to cultivate creative endeavors (NCHC Board of Directors, 2013; Miller, 2018; Villanova & Pina, 2021).

These qualitative findings both confirm and reveal studies related to the Six Thinking Hats interventions; however, other educational, environmental, and personal factors may have shaped their understanding of the Six Thinking Hats. In gifted education pedagogy, other academic experiences such as the influence of the instructor as a mentor or a role model, friendships, and the rigor of the course content could contribute to the honor students' perceptions (Hebert, 2017). Some research studies have shown that peer interactions and the

safety of small groups allow young adults to be vulnerable to each other and open to learning from other students' perspectives.

Contributions of this Study

This study is a first step in contributing to scant literature on the STH method as a creative thinking tool to promote multiple perspective taking and raise awareness for narrowing the gap between K–12 gifted education programs and university honors programs (BattelleforKids, n.d.; Colangelo, 2018). First, the STH method was implemented in the natural settings (i.e., college classrooms) as an experimental study and aligned to the principles of honors program (NHCC, n.d.) and HIP (AAC&U, 2024). Although the results cannot be generalized across different settings, the study can be replicated to observe a functional relation between the intervention and creative problem solving (Gilson et al., 2023; Jung, 2018; Worrell, 2015).

Additionally, this study can potentially inform higher education administrators to consider using the STH method or other creative training programs to enhance efficiency and productivity among faculty and staff members (Miller, 2018). Since the study's thematic analysis also revealed how students valued the creative thinking tool throughout the semester, the university's honors leadership team may use student feedback to offer honors faculty professional learning (Chien, 2021).

Limitations

Several limitations exist in this study. The first limitation was that I was both the researcher and the experimenter who conducted training and intervention for the participants. The invested interests may have inadvertently affected the data because of my constant presence in the classroom, along with the course instructor, who was my doctoral advisor. Second, the

STH training takes one full day of training (de Bono Group 2019); however, I provided 20-min training to each group that might have significantly affected the results). Third, I made two instructional modifications and regrouped the small groups twice, causing instability in the data for Brian and Lori. During the interview, Lori shared that there was less time for her to internalize the STH method since they received the intervention in session 21. Fourth, the classroom environment nested within one semester posed some challenges. For example, the maintenance phase for Brian and Lori was limited to two sessions and concluded on the second to the last day of the coursework. Fifth, the relatively low IOA in the original calculations for each condition resulted in discrepancy in the data. Finally, I had diverse majors and both male and female participants; however, there was only one African American student represented as the participant and no students with known disabilities. The remaining students did not quality for this study because the IPIP criteria did not qualify for introversion. This limited the subject generality.

Directions for Future Research

To date, many empirical studies on gifted education have been largely descriptive and non-experimental (Dai et al., 2010; Plucker & Callahan, 2020). This study was one of the few studies that used the single-case research design to examine the effects of the creative thinking intervention on student's creative problem solving. To minimize the first limitation mentioned above, I recommend conducting additional single-case studies with classroom instructors who can provide student training and intervention. This option would allow me to observe teacher behavior and desired effects of the intervention on students. Collaborating with other like-minded researchers in single-case design would allow providing immediate feedback to students

and provide concrete examples of how their discussion could be improved and will add value to the participants (Fong et al., 2021).

Second, the researcher could use the entire class time or several class periods to provide the STH method training. Third, researchers could conduct a survey on their friendship and acquaintance status, so that students are grouped strategically to avoid instability in the data. Fourth, researchers could conduct different single-case designs to compare two or more different types of creative thinking methods or across classes to reduce the likelihood of time-lagged interventions. Fifth, instead of manually calculating the coding discrepancies, which can cause human error, researchers can use digital programs to swiftly calculate IOAs. Lastly, the study could recruit university honors participants who are multi-lingual or multi-exceptional.

Implications for Practice

Higher education instructors, counselors, or other relevant staff members who interact with introverted honors students may consider integrating the STH as part of the daily routine, whether it be classroom instruction, presentations, or group projects, to establish a culture based on clear communication and structure (Henfield et al., 2014; Hinterplattner et al.,2022; Mun et al., 2020). Additionally, it can also be scaled back or differentiated for students to use as a reflective tool to refine, revise, or organize individual tasks (Chien, 2021). To that end, integrating intentional time for the STH will help additional opportunities to examine the qualitative and quantitative effects of the STH in honors students.

According to Lee and colleagues (2015), the study on problem-based learning among high school students revealed that a group's social skills are integral to collaboration. In this light, a suggestion for honors faculty is to provide structured and directed professional learning on the STH method to honors program directors, deans, and faculty for the purpose of increasing

access to class discussions that include thinking through different perspectives for introverted high-achieving students. As the goal of the honors program is to prepare high-achieving students with the skills and tools to compete and contribute to social changes (NCHC, n.d.), equipping students to enhance creative problem solving through multiple perspective taking can have a long-lasting effect on introverted students. The STH can potentially be a promising practice to promote growth in honors faculty and perceive introverted honors students to become co-facilitators and co-leaders to problem-solve authentic problems and issues.

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APPENDIX A: DEMOGRAPHIC SURVEY

Direction: Please complete the demographic study to participate in the research study on "Effects of Six Thinking Hats on Creative Problem Solving Among Undergraduate Honors Students".

1. First Name
2. Last Name
3. Student ID
4. Date of Birth
5. Gender
6. Ethnicity/Race
7. Languages spoken at home
8. The year enrolled in the University Honors Program
9. Academic Major(s)
10. From what you recall, have you ever been identified as gifted and talented during elementary, middle, or high school years?
11. Have you ever taken advanced programs or courses in middle or high schools?
12. If yes to the question 11, list any of the courses or programs you recall having taken:
13. Have you ever heard of de Bono's Six Thinking Hats?
14. Have you ever used a creative problem-solving process before?

APPENDIX B: INTERNATIONAL PERSONALITY ITEM POOL SURVEY

(*Open-Source Psychometrics Project,* 2023)

Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Indicate for each statement whether it is 1. Very Inaccurate, 2. Moderately Inaccurate, 3. Neither Accurate Nor Inaccurate, 4. Moderately Accurate, or 5. Very Accurate as a description of you.

		Very Inaccurate	Moderately Inaccurate	Neither Accurate Nor Inaccurate	Moderately Accurate	Very Accurate	
1.	Am the life of the party.	O	O	O	O	O	(1+)
2.	Feel little concern for others.	O	O	O	O	O	(2-)
3.	Am always prepared.	O	O	O	O	O	(3+)
4.	Get stressed out easily.	O	O	O	O	O	(4-)
5.	Have a rich vocabulary.	O	O	O	O	O	(5+)
6.	Don't talk a lot.	O	O	O	O	O	(1-)
7.	Am interested in people.	O	O	O	O	O	(2+)
8.	Leave my belongings around.	O	O	O	O	O	(3-)
9.	Am relaxed most of the time.	O	O	O	O	O	(4+)
10.	Have difficulty understanding abstract ideas.	O	O	O	O	O	(5-)
11.	Feel comfortable around people.	O	O	O	O	O	(1+)
12.	Insult people.	O	O	O	O	O	(2-)
13.	Pay attention to details.	O	O	O	O	O	(3+)
14.	Worry about things.	O	O	O	O	O	(4-)
15.	Have a vivid imagination.	O	O	O	O	O	(5+)
16.	Keep in the background.	O	O	O	O	O	(1-)
17.	Sympathize with others' feelings.	O	O	O	O	O	(2+)
18.	Make a mess of things.	O	O	O	O	O	(3-)
19.	Seldom feel blue.	O	O	O	O	O	(4+)
20.	Am not interested in abstract ideas.	O	O	O	O	O	(5-)
21.	Start conversations.	O	O	O	O	O	(1+)
22.	Am not interested in other people's problems.	O	O	O	O	O	(2-)
23.	Get chores done right away.	O	O	O	O	O	(3+)
24.	Am easily disturbed.	O	O	O	O	O	(4-)
25.	Have excellent ideas.	O	O	O	O	O	(5+)
26.	Have little to say.	O	O	O	O	O	(1-)
27.	Have a soft heart.	O	O	O	O	O	(2+)
28.	Often forget to put things back in their proper place.	O	O	O	O	O	(3-)
29.	Get upset easily.	O	O	O	O	O	(4-)
30.	Do not have a good imagination.	O	O	O	O	O	(5-)

31.	Talk to a lot of different people at parties.	O	O	O	O	O	(1+)
32.	Am not really interested in others.	O	O	O	O	O	(2-)
33.	Like order.	O	O	O	O	O	(3+)
34.	Change my mood a lot.	O	O	O	O	O	(4-)
35.	Am quick to understand things.	O	O	O	O	O	(5+)
36.	Don't like to draw attention to myself.	O	O	O	O	O	(1-)
37.	Take time out for others.	O	O	O	O	O	(2+)
38.	Shirk my duties.	O	O	O	O	O	(3-)
39.	Have frequent mood swings.	O	O	O	O	O	(4-)
40.	Use difficult words.	O	O	O	O	O	(5+)
41.	Don't mind being the center of attention.	O	O	O	O	O	(1+)
42.	Feel others' emotions.	O	O	O	O	O	(2+)
43.	Follow a schedule.	O	O	O	O	O	(3+)
44.	Get irritated easily.	O	O	O	O	O	(4-)
45.	Spend time reflecting on things.	O	O	O	O	O	(5+)
46.	Am quiet around strangers.	O	O	O	O	O	(1-)
47.	Make people feel at ease.	O	O	O	O	O	(2+)
48.	Am exacting in my work.	O	O	O	O	O	(3+)
49.	Often feel blue.	O	O	O	O	O	(4-)
50.	Am full of ideas.	O	O	O	O	O	(5+)

APPENDIX C: A LIST OF FOCUSED ISSUES

1. Some members in your semester project group aren't doing their fair share of work, making it challenging to finish the project on time. What actions would you suggest to ensure everyone contributes?

2. The student government must decide how to allocate funds for various student clubs, leading to conflicts about which clubs deserve more support.

3. Two roommates, who were formerly best friends, in university housing have a falling out. They request a room change, but there are limited available rooms and the rents for apartments are too high.

4. A student is accused of cheating on an exam, but there is limited evidence, and the university's academic integrity committee must decide whether to penalize the student.

5. Students want to enroll in a popular elective course with limited seats, and the registrar must decide how to allocate spots fairly.

6 Discuss the shift to renewable energy on our campus, looking at how it helps the environment and what it costs. Decide what's more important for our university: being eco-friendly or keeping costs down.

7. Students are debating how campus jobs should be balanced with academic demands, focusing on ensuring the jobs are meaningful and fairly distributed among them.

8. Classroom Technology Policy: A disagreement arises about whether to allow students to use cell phones, considering their potential benefits and distractions.

9. The university needs to decide how to distribute sports scholarships, taking into account both athletic performance and academic achievements.

10. Students and library staff disagree on the optimal hours of operation for the university library, balancing accessibility and staffing concerns.

11. Honors students and counseling center staff have differing opinions on the allocation of resources for mental health services on campus.

12. University students propose how university parking spaces should be allocated on campus, especially considering limited space.

13. The administration and student body disagree on the level of security measures to be implemented on campus, taking into account privacy and safety concerns.

14. There's a discussion about changing graduation requirements, leading to debates about the value of a well-rounded education versus specialization.

15. There's a conflict in the university over whether to offer/continue offering online courses, with concerns about accessibility, quality, and student engagement.

16. A proposal to switch to a trimester system is met with resistance from students, faculty, and staff, who have varying opinions on the potential benefits.

17. Students are divided on whether to form a union to negotiate for better wages and working conditions.

18. Students and dining services clash over the variety and quality of food options on campus, considering dietary preferences and cost.

19. The plan to modernize campus housing to balance private and communal spaces garners mixed feedback on its impact on fostering community and personal well-being.

20. Policies on free speech zones and event regulations stir debates on balancing free expression with campus safety and inclusivity.

21. Initiatives to introduce a bicycle-sharing program on campus lead to discussions about safety, funding, and the promotion of green transportation.

22. Proposals for mandatory cultural competency training for faculty and students ignite discussions on effectiveness, academic freedom, and fostering an inclusive campus environment.

23. The integration of AI tools in academic research prompts debates on ethical implications, research integrity, and the future of scholarly work.

24. There's a push to create more interdisciplinary degree options, with debates about their viability, job market alignment, and academic rigor.

APPENDIX D: SIX THINKING HATS ONE-PAGER CHART (DE BONO, 1999)

Thinking Type	Symbols	Behavior Descriptions	Sentence frames
 White Hat	information, objectivity, impartiality	• Information I know or need • How the information can be obtained • Determine accuracy and relevance	Information we have is… There was a 25% increase in … The author stated on page 41, ln 1 that...
 Red Hat	intuition, hunches, emotions, feelings	• Permission to express feelings • No need for justification • Gut feeling • One or two words to express feelings	I feel this is the right person for.... I feel the idea has potential I feel this is risky…. My gut tells me that… I sense that...
 Black Hat	logical managing risk	• Points of potential problems • Reasons must be given • Point out thinking that does not fit the facts, experience, regulations, strategy, or values	I don't like the idea of…. My logical reason is that… What we do not have is… The potential problem is that…
 Yellow Hat	speculative, positive	• The optimistic view • Reasons must be given • Needs more effort than the black hat • Finds the benefits and values • Considers both short and long-term perspectives	There is a chance that… It is possible that … It's not likely to fail because… If C, then D (positive) In the best possible scenario.... I have this vision of...
 Green Hat	creative	• Creative thinking • Seeks alternatives and possibilities • Removes faults • Doesn't have to be logical • Generates new concepts	An alternative way of seeing this situation is… A new concept is that… A different way of seeing is that …
 Blue Hat	control, monitoring, summary, focus program design	• Organizes thinking • Sets focus and agenda • Summarizes and concludes • Ensures that the rules are observed	The goal of this session is … In summary… As a reminder, the rules are…

APPENDIX E: TRAINING SCRIPT FOR THE SIX THINKING HATS

Steps	Interventionist Behavior	Student Behavior (Responses may vary)
Step 1	Say: Today, I will introduce to you a method on how to engage everyone to participate in group discussions using the Six Thinking Hats method. I am passing out a folder that contains 2 things. A copy of the Six Thinking Hats One-Pager Chart and six cards with an image on one side and questions prompts to guide your thinking. You may open the folder. The definition of the STH method is a thinking approach that allows each member to think in a direction parallel to the others rather than in opposition to solving problems. It enables the group to explore different perspectives and ideas more efficiently, leading to more productive and effective outcomes as a group. The STH method also increases creative process to solve problems.	Students listen to the interventionist. Each student receives a folder. Students open the folder.
Step 2	Let's review each hat using a focused issue: planning for my future career.	
Step 3	The types of White Hat thinking are information, objectivity, and impartiality. Behavior descriptions include information I know or need to know.	
Step 4	Let's provide some White Hat thinking about "Planning for My Career". (Interventionist confirms or redirects if students do not provide White Hat thinking.)	Students provide White Hat thinking.
Step 5	The types of Red Hat thinking are intuition, hunches, emotions, and feelings. Behavior descriptions include gut feeling and you do not justify your feelings.	
Step 6	Let's provide some Red Hat thinking about "Planning for My Career". (Interventionist confirms or redirects if students do not provide Red Hat thinking.)	
Step 7	The types of Yellow Hat thinking are logical positive. It is seeing value in an issue or an idea. Behavior descriptions include] The optimistic view; Reasons must be given	
Step 8	Let's provide some Yellow Hat thinking about "Planning for My Career". (Interventionist confirms or redirects if students do not provide Yellow Hat thinking.)	
Step 9	The types of Black Hat thinking are logical critical. It points out potential problems, difficulties, and dangers.	
Step 10	Let's provide some Black Hat thinking about "Planning for My Career".	

	(Interventionist confirms or redirects if students do not provide Black Hat thinking.)	
Step 11	The types of Green Hat thinking are creative. It seeks alternative and possibilities and do not have to make logical sense.	
Step 12	Let's provide some Green Hat thinking about "Planning for My Career". (Interventionist confirms or redirects if students do not provide Green Hat thinking.)	
Step 13	The types of Blue Hat thinking is control, monitoring, summary. It organizes thinking, sets focus, and agenda, summarizes, and concludes.	
Step 13	Let's provide some Blue Hat thinking about "Planning for My Career". (Interventionist confirms or redirects if students do not provide Black Hat thinking.)	
Step 9	Can I get a volunteer to read aloud today's focused issue?	A student reads aloud the focused issue.
Step 5	Now that we understand the focused issue, let's focus on one hat at a time. I will be the blue hat as the facilitator. I will lead the conversation, summarize, and close the session at the end. I will decide the sequence of the hats.	
Step 6	The interventionist then records their ideas and conclusions and asks each student to see if something is missing.	
Step 7	The interventionist compiles potential next steps and asks student's approval.	
Step 8	Repeat Step 3 – 6 using a different prompt. This time tell students that you will be timing them. Blue Hat (.5 min) Yellow Hat (1 min) White Hat (1 min) Black Hat (2.0 min) Green Hat (2.0 min) Red Hat (30 seconds) Blue Hat (.5 min)	
Step 9	Teacher says: Do you have any questions about the training? If not, this is the end of the Hat training session.	Students may ask any clarifying questions.

APPENDIX F: INTERVENTIONIST SCRIPT FOR THE SIX THINKING HATS

Materials: 5 folders, Hat chart, laminated cards, pencils, sticky notes, and a timer

Steps	Interventionist Behavior	Student Behavior (Responses may vary)	Checklist
		Student volunteer says: • Turn on the recording. • Today is… and time. • Say the pseudonyms. Student volunteer says: Discussion begins	
1	Say: [I will now pass out] the folders that contain the hat chart and laminated cards to help you remember what they stand for.	Each student receives a copy of the Six Thinking Hats One-Pager Chart.	Yes No
2	Say: Let's review the Six Thinking Hats method. What is the definition of STH? Say: Let's review each hat. White hat (information; clues are documents and papers) Black (critical logical hat; clue is the judge's robe) Blue (meta-cognitive hat; the sky; yellow - optimist hat sunshine green - nature, red - passion).	Students actively listen to the interventionist. They can provide any of the following: It includes six metaphorical "hats" that indicate the type of thinking you could do while problem solving in a group. We all wear the same colored hat at the same time to think parallel to each other.	Yes No
3	1. We will designate minutes per hat. 2. During green hat time, I will provide an independent thinking time of 15 seconds to jot down your green hat ideas before sharing.		Yes No
4.	As a group, let's sequence the hats. We will use blue hat as bookends.	Students provide suggestions.	Yes No
5	Let's designate time for each hat. I will…		
6.	I will be the blue hat wearer as the facilitator. I will facilitate, summarize, and close the session at the end. Anybody can be a blue hat wearer!		Yes No

7.	[During discussion] The interventionist writes their ideas and provides summaries during green hat time. She asks each student to see if something is missing.	Students listen to the interventionist and provider reminder if anything is missing.	Yes No
8.	The interventionist compiles potential next steps and seeks student feedback.	Students listen to the interventionist.	Yes No
9.	Teacher says: Do you have any questions about today's training/intervention?	Students may ask any clarifying questions.	Yes No
10.		Student volunteer says: This is the end of recording. Say the time.	Yes No

APPENDIX G: BASELINE AND MAINTENANCE SCRIPTS

1	The interventionist says to students, "You will receive 4X6 discussion cards that have a focused issue written on them."
2	The interventionist hands out the cards.
3	The interventionist says/reminds students: "(1) When you turn on the recorder, say "Discussion begins" with today's date and time (e.g. Today's January 18th, 2024, 10:20 am) and everybody's pseudonyms, (2) Be sure to use the pseudonym to refer to yourself and others, and (3) When the discussion is complete, say "Discussion Ends" and say the time (e.g. 10:35 am).
4	Interventionist asks if they have any clarifying questions about the focused issue, and if there are, she clarifies for students.
5	Interventionist asks the groups to pick up their folders, audio recorders, and start the discussion.

APPENDIX H: STH DATA RECORDING SHEET

Date:
Participant Name:
Scorer Name:

IOA Name:

Session	Date	Phase	Start Time	End Time	# of Partici-pation	Type of Hat	# of total words per Hat	# of Creative Thinking Ideas

APPENDIX I: PROCEDURAL FIDELITY CHECKLIST FOR TRAINING STEPS

Steps	Experimenter Behavior & Direction	YES	NO
1	The interventionist uploads and unlocks the slide that has the Six Thinking Hats definition, description, and sentence stems.		
2	The interventionist introduces each hat and explains the role of each hat in the thinking process.		
3	The interventionist provides a real-life scenario.		
4	The interventionist asks a student volunteer to read aloud a scenario for everyone.		
5	The group should then focus on one hat at a time, with all members adopting the same hat thinking.		
6	The interventionist then records their ideas and conclusions and asks each student to see if something is missing.		
7	The interventionist compiles potential next steps and asks student's approval.		
8	The interventionist repeats Step 5 through 7 and uses the timer for each hat. Yellow Hat (1.5 min) White Hat (1.5 min) Black Hat (2.0 min) Green Hat (2.0 min) Blue Hat (1.5 min) – Interventionist Red Hat (30 seconds)		
Step 9	The interventionist asks if students have any clarifying questions and wraps up the training.		

APPENDIX J: PROCEDURAL FIDELITY CHECKLIST FOR BASELINE AND MAINTENANCE

Steps	Experimenter Behavior & Direction	YES	NO
1	The interventionist says to students, "You will receive 4X5 discussion cards that have a focused issue written on them."		
2	The interventionist hands out the cards.		
3	The interventionist says/reminds students follow the direction on the slides: (1) When you turn on the recorder, say 'Discussion begins' with today's date and time (e.g. Today's January 18th, 2024, 10:20 am) and everybody's pseudonyms, (2) Be sure to use the pseudonym to refer to yourself and others, and (3) When the discussion is complete, say 'Discussion Ends' and say the time (e.g. 10:35 am).		
4	Interventionist asks if they have any clarifying questions about the focused issue, and if there are, she clarifies for students.		
5	Interventionist asks the groups to pick up their folders, audio recorders, and start the discussion.		

APPENDIX K: PROCEDURAL FIDELITY CHECKLIST FOR INTERVENTIONS

Steps	Experimenter Behavior & Direction	YES	NO
1	Say: [I will now pass out] the folders that contain the hat chart and laminated cards to help you remember what they stand for.		
2	Say: Let's review the Six Thinking Hats method. What is the definition of STH? Say: Let's review each hat. White hat (information; clues are documents and papers) Black (critical logical hat; clue is the judge's robe) Blue (meta-cognitive hat; the sky; yellow - optimist hat sunshine green - nature, red - passion).		
3	1. We will designate minutes per hat. 2. During green hat time, I will provide an independent thinking time of 15 seconds to jot down your green hat ideas before sharing.		
4	As a group, let's sequence the hats. We will use blue hat as bookends.		
5	I will be the blue hat wearer as the facilitator. I will facilitate, summarize, and close the session at the end. Anybody can be a blue hat wearer!		
6	[During discussion] The interventionist writes their ideas and provides summaries during green hat time. She asks each student to see if something is missing.		
7	The interventionist compiles potential next steps and seeks student feedback.		
8	Teacher says: Do you have any questions about today's training/intervention?		
9	The interventionist asks if students have any clarifying questions		
10	The intervention ends the intervention session.		

APPENDIX L: CREATIVITY AND CREATIVE PROBLEM-SOLVING COURSE TOPICS

Session 1	Introductions: Exploring your conceptions of creativity
Session 2	Overview: The 4 Ps
Session 3	The 5 As
Session 4	The Four C's: Levels of Eminence
Session 5	Creativity across Domains
Session 6	Creativity and Culture
Session 7	Unit 1 Wrap Up
Session 8	Divergent Thinking Part 1
Session 9	Associative Thinking & Divergent Thinking Part 2
Session 10	Convergent Thinking
Session 11	SCAMPER mini-projects Unit 2 Wrap Up
Session 12	A Brief Primer on the history of Creative Problem Solving Models
Session 13	CPS: Clarify - Explore the Vision
Session 14	CPS and Social Justice
Session 15	Researcher Skills
Session 16	CPS: Clarify - Gather Data Part 1
Session 17	CPS: Clarify - Gather Data Part 2 Unit 3 Wrap Up
Session 18	Creativity & Personality
Session 19	Creativity & Motivation
Session 20	Creativity & Intelligence
Session 21	Ethics and Consequences of Creativity Unit 4 Wrap Up
Session 22	CPS: Clarify - Formulate Challenges
Session 23	CPS: Ideate – Explore Ideas
Session 24	Synthesizing – A process for research and creativity
Session 25	CPS: Develop – Formulate Solutions
Session 26	CPS: Implement – Formulate a Plan Unit 5 Wrap Up
Session 27	Authentic audiences Presentation skills
Session 28	Product Showcase
Session 29	Product Showcase
Session 30	Product Showcase & Course Wrap Up

APPENDIX M: SOCIAL VALIDITY OPEN-ENDED QUESTIONS

Script: Thank you for participating in my research study and the interview. I have four open-ended questions and four follow-up questions.

1. Can you describe your overall experience using the Six Thinking Hats during small group discussions?
    a. In what ways, do you think, the Six Thinking Hats method influenced your ability to engage with different perspectives during discussions?
    b. In what ways, you do think, the Six Thinking Hats method helped or hindered your participation?
    c. In what ways, you do think, the Six Thinking Hats method helped or hindered your creative thinking?
    d. Of the six Hats, which one did you find most comfortable and why? Which was the most challenging to use and why?
2. Have you had the opportunity to apply the Six Thinking Hats method in situations outside the classroom? If yes, would you share how it went?
3. If you haven't used the Six Thinking Hats outside of class, how do you think you might be able to use this method in other areas of your life?
4. Based on your experience, are there any changes or improvements you would suggest for using the Six Thinking Hats method in future small group discussions?

APPENDIX N: STEPS FOR GENERATING FOCUSED ISSUES

STEP 1	Go to “Get started” on https://openai.com/gpt-4
STEP 2	Create an account.
STEP 3	When the search box appears at the bottom of the screen, input the following formula: Generate 30 problem-solving scenarios based on the following criteria. : (1) Each scenario must be 3 -4 sentences (2) Each scenario must be relevant to the perspectives of emerging adults, young adults, college, or university studies (3) The issue must encompass a wide range of topics, current events, and issues.
STEP 4	Click the send icon.
STEP 5	Copy and paste the 30 scenarios.
STEP 6	Refine and revise the scenarios and consult university specialists, who conduct training on the use of AI as writing tools, and professors who specialize in gifted education and special education.

APPENDIX O: DEFINITIONS OF DEPENDENT VARIABLES

Dependent Variables	Definition	Inclusion Criteria	Example	Non-Example
Total Number of Hats	represented by colors (e.g., red, white, yellow, black, blue, and green), which symbolize a disciplined way of thinking	See STH Definitions & Examples Tab	**See Appendix D**	**See Appendix D**
Total Number of Topic-Related Participation (TRP)	a continuous verbal statement a participant expresses at a given time during dialogic discourse (Casa et al., 2020). A participation unit can be a statement, question, or response to another student about a topic. A participation unit is counted as one when the participant initiates a statement or question form during dialogic discourse.	An inclusion criteria for a single unit of TRP will be (a) a continuous verbal output related to the topic and (b) the first word to the last word spoken. When a participant's verbal output is interrupted by another student in the group, the continuation of the participant's verbal output will be counted as a new unit of participation.	*The discussion topic is about Elie Wiesel's story "The Watch".* Yeah. He entered the courtyard. Its background is probably Hungary or something, and he has a garden in courtyard. He was probably wealthy. Unless every home has a courtyard. I don't know. That's, what do you think, Justin?	The discussion topic is about Elie Wiesel's story "The Watch". When does the class end?
Total Number of Creative Thinking	an alternative and unusual ideas verbally expressed during dialogic discourse	(a) the idea must be novel or new, and (b) the idea does not require logical or realistic thinking or solution.	*The discussion topic is about how to motivate college students to be punctual.* Maybe offer a full semester tuition refund if students arrive on time to class	*The discussion topic is about how to motivate college students to be punctual*. Just be punctual, that's all.

			for the entire semester. (The statement is not doable but counts as a novel idea.)	
Total Number of Topic-Related Words per Hat	A number of verbal output per hat	The criteria for counting words of an individual will include words spoken of a participant related to the topic. Filler words, such as "um," "like," "okay," and "you know," spoken as a single unit by an individual will be excluded from the topic-related words. I will also remove consecutive duplicates of same words, or self-correction of mispronounced words.	It seems like the peak seems like, um, he was joking out of, I mean, it looks like he was driven out of his house.(20 words/counts)	I mean... hm... um... yeah. (0 word/count)

APPENDIX P: EXAMPLES OF METHODS/ANALYTIC MEMO

Date	Analytic Memo
5/10	During the initial coding, what jumped at me was Lori's overall experience which seemed different from those of others. She had an evaluative lens on the use of the Six Thinking Hats method. She felt like she did not have enough opportunities. This is understandable because she was part of the last group that received the Six Thinking Hats training and interventions.
5/11	What I am surprised with students' responses about how the STH helped, they used some examples of the role of each hat and what it does. They used verbs like, challenge, helped, forced, and interact..etc.
5/14	Brian's definition of participation went beyond verbal expressions. He included listening behavior as part of his participation. This is very insightful.

Date	Methods Memo
5/5	I organized the spreadsheet by the interview questions. For each interview question, I included each participant's responses. This helped me get a gist of participant responses. Rereading and reading aloud helped me sensitize myself to "the story" they were telling me about the Six Thinking Hats.
5/11	I reread Sandana's (2021) qualitative In Vivo coding process. He provided concrete steps and examples I could follow. First, I took notes on words and phrases that jumped out at me on the right side (See the Initial Notes tab). The notes became my initial codes, which I numbered them for my second coder to check. I clustered them by a set of codes that belonged together (See In Vivo Coding 1). Lastly, I extracted the themes by analyzing the cluster of codes. Grouping the 2nd question about multiple perspectives went through an iterative process of grouping and regrouping. I came down to two themes: providing
5/12	Grouping the 2nd question about multiple perspectives went through an iterative process of grouping and regrouping. I came down to two themes: providing
5/23	I read the data for the first question again and removed two intial codes that were redundant. (e.g. I treated "it allowed me to think in different ways and thinking different perspectives" as one code instead of two separate codes because ways and perspectives are synonyms.

APPENDIX Q: THE SIX THINKING HAT METHOD CODEBOOK

Research Question 5: What are the perspectives of introverted university honors students on the use of the STH method within and outside of the honors classroom setting?

Question 1. Can you describe your overall experience using the Six Thinking Hats in small group discussions?

	Initial Codes	Initial Codes on Jamboard	Grouping
1	more productive and organized		Cluster them by belonging and an order of some kind (Saldana, 2021, p.140) 
2	see different angles		
3	before there were distractions and got sidetracked		
4	hats brought us back		
5	before learning hats, there was no structure		
6	never came up without ideas and solutions		
7	definitely liked the Green Hat		
8	helped us get to know more about the problems		
9	realized that some of knew more about the topic		
10	thinking different perspectives		
11	before hats, we think one way or in one hat and stick to it		
12	broaden up		
13	speak in different ways		
14	think in different ways		
15	enjoyed the experience		
16	my discussion improved		
17	smoother discussion		
18	did not master them because the group went last		
19	we didn't stay in the hat (crossover)		
20	effective to stay on the same page		
21	guide our discussions		

Categories	Subsuming/Regrouping	Themes
15. enjoyed the experience	**23. guide our discussions**	**Quality of group discussions improved after the Six Thinking Hats method.**
8. realized that some of knew more about the topic	1. more productive and organized	
7. definitely like the Green Hat	4. hats brought us back	
	17. my discussion improved	
9. a different way of doing things	18. smoother discussion	
2. see different angles	22. effective to stay on the same page	
10. helped us get to know more about the problems	**5. before learning hats, there was no structure**	
11. thinking different perspectives	3. before there were distractions and got sidetracked	
12. broaden up	6. never came up with ideas and solutions	
13. speak in different ways	16. before hats, we think one way or in one hat and stick to it	
14. think in different ways	**15. enjoyed the experience**	
	8. realized that some of knew more about the topic	
5. before learning hats, there was no structure	7. definitely like the Green Hat	
3. before there were distractions and got sidetracked		
6. never came up with ideas and solutions	**9. a different way of doing things**	**Changes occured in thinking and speaking behavior through multiple perspectives.**
16. before hats, we think one way or in one hat and stick to i	2. see different angles	
	10. helped us get to know more about the problems	
	11. thinking different perspectives	
	12. broaden up	
19. did not master them because the group went last	13. speak in different ways	
20. we didn't stay in the hat (crossover)	14. think in different ways	
	19. did not master them because the group went last	**The last group lacked the time to master the Six Thinking Hat Method.**
	20. we didn't stay in the hat (crossover)	