Early Adolescents' Basic Psychological Need Satisfaction and Frustration, Motivation, and Verbal Divergent Thinking within an Out-of-School Context

Megan Louise Atha

University of South Florida

Follow this and additional works at: https://scholarcommons.usf.edu/etd

Part of the Educational Psychology Commons

Scholar Commons Citation

Atha, Megan Louise, "Early Adolescents' Basic Psychological Need Satisfaction and Frustration, Motivation, and Verbal Divergent Thinking within an Out-of-School Context" (2020). Graduate Theses and Dissertations.
https://scholarcommons.usf.edu/etd/8232

This Dissertation is brought to you for free and open access by the Graduate School at Scholar Commons. It has been accepted for inclusion in Graduate Theses and Dissertations by an authorized administrator of Scholar Commons. For more information, please contact scholarcommons@usf.edu.
Early Adolescents' Basic Psychological Need Satisfaction and Frustration, Motivation, and Verbal Divergent Thinking within an Out-of-School Context

by

Megan Louise Atha

A dissertation submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in Curriculum and Instruction with a concentration in Educational Psychology Department of Educational and Psychological Studies College of Education University of South Florida

Major Professor: Darlene M. DeMarie, Ph.D.
Robert Dedrick, Ph.D.
Clint Randles, Ph.D.
Tony Tan, Ed.D.

Date of Approval:
June 19, 2020

Keywords: creativity, self-determination theory, extracurricular contexts

Copyright © 2020, Megan Louise Atha
Dedication

To Frankie and Owen -- my wonderfully brilliant, loving, creative, patient – oh so very patient – kids who have championed me on this journey.

To Gay Ellen Atha – my steadfast, nerdy mother whose own love of learning infected me with the same curiosity and interest in understanding life’s phenomena through the lens of a researcher.

To the memory of my father, David Thompson Atha – no one has embodied more the “work hard, play hard” ethos than my dad.
Acknowledgments

Many dear people have supported me while I pursued my doctoral degree and for whom I am sincerely grateful. The support was offered in diverse ways and over many years. First, I want to thank my major advisor, Dr. Darlene DeMarie, not only for the guidance in the development of this research and for nurturing my development as a professional, but for her positivity and expressions of confidence in me. These affirmations offered nourishment during challenging times. Her advocacy for my needs as a graduate student working full-time and raising kids motivated me to not only finish this work but to see myself as scholar within my discipline. For that I am deeply grateful. I also want to express my sincerest appreciation to Dr. Robert Dedrick, whose patience, attentive mentoring, and professionalism have taught me just as much as his classes on educational measurement and research methodology. When I think about what kind of professor I want to be, I think of him. Additionally, I am appreciative of my committee members, Dr. Tony Tan and Dr. Clint Randles whose thought-provoking feedback has served to strengthen this work. A few others are deserving of recognition for their roles in supporting me. Katie Jansen and Britt Monroe - for their help in scoring creativity tasks and for their moral support, too! Dr. Jonathan Plucker – for friendly scholarly banter that helped me foment a research interest. Dr. Paul Silvia and Dr. Richard Hass for guidance on measurement of divergent thinking and for sharing protocols.

Finally, I want to thank my amazing mother, Gay Ellen Atha, for keen copy-editing skills and for her willingness to be a research assistant (of sorts) throughout this project. How lucky I am!
Table of Contents

List of Tables .................................................................................................................................. iii

List of Figures ................................................................................................................................... iv

Abstract ............................................................................................................................................ v

Chapter I: Introduction .................................................................................................................... 1
  Creativity and Intrinsic Motivation During Adolescence .......................................................... 2
  Out-of-School Contexts .................................................................................................................. 5
  Theoretical Frameworks .................................................................................................................. 6
    Self-Determination Theory Overview ....................................................................................... 7
    Intrinsic Motivation Principle of Creativity Overview ................................................................. 8
    Need Supportive Contexts ............................................................................................................. 9
  Purpose of the Current Study .......................................................................................................... 10
  Definition of Key Terms ................................................................................................................ 10
    Early Adolescence ......................................................................................................................... 10
    Odyssey of the Mind Context ......................................................................................................... 11
    Need Satisfaction and Frustration ................................................................................................. 11
    Motivation ..................................................................................................................................... 11
    Creativity ..................................................................................................................................... 12
      Divergent Thinking ...................................................................................................................... 13
  Research Questions ....................................................................................................................... 14
  Research Hypotheses ..................................................................................................................... 14
  Contributions to the Literature ....................................................................................................... 18

Chapter II: Review of the Literature .............................................................................................. 20
  Defining Creativity ........................................................................................................................ 20
  Creativity Development during Early Adolescence ...................................................................... 23
  Intrinsic Motivation Principle of Creativity .................................................................................. 27
  Individual Differences in Creativity ............................................................................................... 30
    Cognitive Abilities ......................................................................................................................... 30
    Personality Characteristics ............................................................................................................ 32
  Self-Determination Theory ........................................................................................................... 33
    Basic Psychological Needs Theory ............................................................................................. 34
    Cognitive Evaluation Theory ......................................................................................................... 35
    Organismic Integration Theory ..................................................................................................... 36
    Individual Differences in Needs Strength. .................................................................................... 38
    Contextual Factors for Need Satisfaction .................................................................................... 38
  Autonomous Motivation and Adolescent Creativity ..................................................................... 39
  Need Supportive Teaching ............................................................................................................ 41
List of Tables

Table 1: Frequency of Team Membership ................................................................. 60
Table 2: Demographic Characteristics of Participants ................................................. 61
Table 3: Number of Items per Domain by Motivation Subscales ................................. 66
Table 4: Research Questions Aligned to Analytic Strategy ........................................ 70
Table 5: Psychometric Properties of Study Measures .................................................. 74
Table 6: Paired Samples $t$-tests Between Need Satisfaction and Need Frustration .... 74
Table 7: Means, Standard Deviations, Skewness, and Kurtosis of Observed Need Satisfaction Variables ................................................................. 77
Table 8: Means, Standard Deviations, Skewness, and Kurtosis of Observed Need Frustration Variables ................................................................. 78
Table 9: Correlations Between All Latent Variables of Interest ................................... 79
Table 10: Means, Standard Deviations, Ranges, Skewness, and Kurtosis of Observed Verbal Divergent Thinking Variables ......................................................... 82
Table 11: Correlations Among Need Satisfaction, Need Frustration, and Motivation .... 94
Table 1A: Means, Standard Deviations, Ranges, Skewness, and Kurtosis of Observed Need Satisfaction Variables ......................................................... 150
Table 2A: Item Stems Aligned to Item Number on Motivation Measure ..................... 152
**List of Figures**

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Integration and Alignment of Theoretical Frameworks</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Componential Model of Creativity</td>
<td>28</td>
</tr>
<tr>
<td>3</td>
<td>Organismic Integration Theory Taxonomy of Regulatory Styles</td>
<td>38</td>
</tr>
<tr>
<td>4</td>
<td>Factor Structure Model for Need Satisfaction and Need Frustration</td>
<td>49</td>
</tr>
<tr>
<td>5</td>
<td>Batey’s Graphical Representation of New Heuristic Framework for</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Creativity Measurement</td>
<td></td>
</tr>
</tbody>
</table>

iv
Chapter 1: Introduction

Adolescence is a critical period for the development of creative thinking (Kleibeuker, DeDreu & Crone, 2016) and behavior (Beghetto & Dilley, 2016; Forgeard & Benson, 2017). The development of each has important implications for adolescent adjustment (Baer, 2016; Barbot, Besançon & Lubart, 2014). Engagement and commitment to creative activities can help adolescents develop positive self-esteem as well as provide outlets for adaptive self-expression (Barbot & Heuser, 2017). Additionally, the cognitive processes associated with creative thinking have been linked to adaptive capacities to cope in stressful situations (Runco, 2004). Despite these examples, research on creativity development during adolescence is limited (Barbot, Besançon & Lubart, 2014; Barbot & Heuser, 2017). Instead, most research on creativity has examined adult and children populations with a primary focus on divergent thinking, an important micro-process hypothesized to embody important facets of creativity such as fluency, originality, flexibility, and elaboration (Kaufman, Plucker, & Baer, 2008).

This typical research focus on micro-processes to the exclusion of systems approaches may be related to J. P. Guilford’s (1950) influential presidential address to the American Psychological Association in which researchers were called to begin lines of inquiry focused on distinguishing creativity from related constructs such as intelligence. In the decades following Guilford’s speech, scholars chiefly examined creativity from either a psychometric approach or as an attribute of personality (Hennessey, 2017; Plucker & Makel, 2010).

Since Guilford’s address, scholars have conceptualized creativity as a multifaceted construct affected by within-person and contextual factors (Amabile, 1996; Barbot, Besançon &
Lubart, 2014; Csikszentmihalyi, 1996) as well as within a sociocultural milieu (Glăveanu et al., 2019). Research on contextual factors contributing to creativity has included the roles of parent-child relationships (Kwaśniewska et al., 2018), cultural definitions of creativity (Niu, 2007), and teacher perceptions of creativity (Beghetto, 2006). One important area of research that incorporates both within-person and contextual factors is motivation. Without motivation to engage in creative processes, the capacity for youth to develop creative thinking is dubious. What motivates a child or an adult to think creatively and to be engaged in creative production may not motivate an adolescent. The ways in which attributes of the environment influence adolescent creative thinking is an underexplored area of research. As the field begins to adopt more developmental approaches to the understanding of creative thinking and behaviors, more research is needed to build upon knowledge of both individual and contextual factors contributing to creativity development, specifically during adolescence (Baer, 2016; Barbot & Heuser, 2017; Glăveanu, 2012; Russ, 2010).

**Creativity and Intrinsic Motivation During Adolescence**

Creativity is often conceptualized as a dynamic *process* that results in an idea or product that is considered “novel” and “useful” within a sociocultural context (Amabile, 1996; Glăveanu et al., 2019; Mumford, 2003; Plucker et al., 2004). Motivation to engage in creative processes is likely to influence creative performance at varying degrees (Csikszentmihalyi, 1996). A large body of evidence has shown that intrinsic motivation (i.e., behaviors originating from an inherent drive or from a person’s will and interest rather than from rewards or pressures) is strongly associated with creativity (Amabile, 1996; Hennessey & Amabile, 2010; Hennessey, 2019). Yet, there is a paucity of research examining specifically how intrinsic motivation relates to creativity during early adolescence.
Furthermore, within creativity research, motivation is typically conceptualized as either “intrinsic” or “extrinsic,” suggesting that motivated behaviors related to creativity stem entirely from within or entirely from outside an individual. This dichotomous treatment of motivation can be problematic when investigating the wide range of motivations adolescents experience when engaged in creative processes and within differing environments (Luria & Kaufman, 2017). For example, do adolescent youth compete in robotics competitions because they want to or because their parents say they must? Do youth sign up for jazz band because they enjoy the creative experience, or because they know doing so looks good on a college application? Do motivations to engage in creative processes tend to change as youth get older? These questions illustrate that is it likely that not all motivation for engaging in creative pursuits can easily be labeled as coming wholly from within oneself. More studies are needed that extend the conceptualization of motivation beyond the intrinsic-extrinsic paradigm so that a more nuanced understanding of how motivation is context-dependent and how it affects creative processes during adolescence.

To address this need, the present study employed Self-Determination Theory as an organizing framework for analysis (Deci & Ryan, 2000; Ryan & Deci, 2017). This theory articulates a range of human motivational regulatory styles (from more autonomously regulated motivation to more controlled) and describes how people tend to internalize and integrate attitudes, values, and behaviors. For youth to not only choose to engage in but also choose to persist in creative processes, some degree of autonomous regulation is required even if the behaviors do not originate from within the person. The extent to which differing developmental contexts promote the internalization and integration of positive attitudes and values towards creativity is an understudied yet active area of research today (Hennessy, 2019).
When the behaviors originate from within the person, the motivation is considered to be “intrinsic.” Intrinsically motivated youth experience enjoyment and interest in activities in which they choose to engage. According to Self-Determination Theory, intrinsic motivation is facilitated when basic psychological needs for competence, autonomy, and relatedness are satisfied. Competence, autonomy, and relatedness are viewed as essential nutrients for psychological health and well-being (Deci & Ryan, 2000; Ryan & Deci, 2017). There is a need to determine if satisfaction of these three needs are also essential nutrients for creativity.

Research has demonstrated that both contextual (e.g., controlling parenting styles, peer rejection, lack of classroom structure) and interpersonal factors (e.g., neuroticism, fixed mindsets, lack of self-efficacy) can thwart the satisfaction of basic psychological needs (Chen et al., 2015; Ryan & Deci, 2017). It is necessary to examine how needs are supported or thwarted in environments where creativity is meant to be fostered during adolescence. These conditions are referred to as need satisfaction and need frustration. The relationships of need satisfaction and need frustration to motivation to engage in creative processes has not yet been explored.

Finally, research has not yet explored how these aspects of motivation relate to those micro-processes important for creative thinking. What is the connection between a “need supportive” environment (Stroet et al., 2013) and an individual youth’s creative thinking? Research shows that creativity is fostered when acquisition of creativity-relevant skills (e.g., brainstorming, problem-solving, dimensional thinking, divergent thinking, etc.) are supported (Starko, 2014). This study examined the degree to which need satisfaction and need frustration correlated with individual creative performance (as measured by a series of verbal divergent thinking tasks). These divergent thinking tasks closely resembled the kind of creative thinking
youth experienced in a unique out-of-school context designed to support creative problem-solving (Guilford, 1967; Silvia, 2008).

**Out-of-School Contexts**

Constraints placed on American public schools requiring the allocation of classroom time to literacy and mathematics learning outcomes are often seen as barriers to creativity development in the classroom (Beghetto & Kaufman, 2010; Besançon, Fenouillet, & Shankland, 2015; Kim, 2011). Therefore, fostering creative thinking and behavior may be uniquely supported through participation in out-of-school activities (Hartzell & Hong, 2016; Mahoney et al., 2005). Participation in extracurricular programs may afford youth an opportunity to practice domain-relevant skills, which in turn may promote competence and competence self-beliefs in that domain (Jacobs, Vernon, & Eccles, 2005). Although research has examined extracurricular involvement and creativity (Milgram & Hong, 1999), it has focused primarily on college-aged students (e.g., Cotter, Pretz, & Kaufman, 2016). There is a need to explore how out-of-school contexts may provide an “optimal fit” for adolescent creativity development (Barbot, Lubart, & Bescançon, 2016; Silva, Christensen, & Cotter 2016). The current study focused on the Odyssey of the Mind Creative Problem-Solving Competition, a potentially rich developmental context for supporting creativity during adolescence.

Odyssey of the Mind (OM) is an international extracurricular program in which groups of five to seven youth work collaboratively over a six-month period to design a creative solution to one of five “long-term” problems (see Appendix A). The youth must also demonstrate originality during an improvisational, “spontaneous” performance (Creative Competitions, Inc., 2018). Both aspects of the Odyssey of the Mind program are intended to enhance cognitive flexibility, problem-solving, and creative ideation. Each team’s problem-solving and creative production is
showcased at a regional competition each spring. A panel of judges assesses the team solutions to the “long-term” problems. Judges also assess individual creativity exhibited by each team member during the “spontaneous thinking” challenge, and individual scores are pooled into a team score. Judges evaluate both the creative products and the spontaneous thinking for originality and style. High-performing teams advance to a state competition and then to a “world” competition by late May or early June.

A key aspect of the program is the requirement that youth are self-directed in their work. Although each Odyssey of the Mind team is coached by an adult mentor during the program, youth are expected to develop competence in the skills required of them to develop a solution as well as to demonstrate autonomy and agency throughout the development of the creative solutions. Not only are competence and autonomy fostered in Odyssey of the Mind, feelings of belongingness may be fostered through the Odyssey of the Mind requirement that youth work in teams. Due to these opportunities afforded youth to engage in creative processes theoretically conducive to supporting basic psychological needs, the Odyssey of the Mind context was selected for this study.

**Theoretical Frameworks**

Theories about human motivation offer promise for understanding how individual and contextual factors interact and relate to creativity development. The present study was guided by two motivation theories:

   a. Basic Psychological Needs Mini-Theory
   b. Cognitive Evaluation Mini-Theory
   c. Organismic Integration Mini-Theory
2. Intrinsic Motivation Principle of Creativity (Amabile, 1983; 1996)
Figure 1 depicts an alignment of the theoretical frameworks guiding the present study. Situated within the tradition of social psychology, these theories together advance a perspective that contextual factors contribute to an individual’s drive to engage in creative thinking and behavior.

**Self-Determination Theory Overview.** Self-determination theory is a macro-theory comprised of six mini theories that together articulate a cohesive framework for understanding human motivation, development, and wellness (Deci & Ryan, 1985; 2000; 2017). Self-determination theory posits that motivation may be conceptualized along a continuum (ranging from extrinsic to intrinsic) and is contingent upon the satisfaction of three basic psychological needs: competence, autonomy, and relatedness (Deci & Ryan, 2000; 2017). Three of the six mini theories:

<table>
<thead>
<tr>
<th>Mini-Theories</th>
<th>Key Constructs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Psychological Needs Theory</td>
<td>Need Frustration</td>
</tr>
<tr>
<td>Organismic Integration Theory</td>
<td>Need Satisfaction</td>
</tr>
<tr>
<td>Cognitive Evaluation Theory</td>
<td></td>
</tr>
</tbody>
</table>

**Self-Determination Theory**
- Domains-relevant Skills
- Creativity-relevant processes
- Task Motivation

**Creativity**
- Originality
- Fluency
- Flexibility

**Motivation**
- Controlled
  - External (compliance, external rewards, punishments)
  - Introjected (self-control, ego-involvement, contingent self-esteem)
  - Identified (personal importance, conscious valuing)
- Intrinsic (enjoyment, inherent satisfaction, interest)

**Integration and Alignment of Theoretical Frameworks**

*Figure 1: Alignment and Integration of Theoretical Frameworks in Present Study*
theories have influenced the design of this study: Basic Psychological Needs Theory, Cognitive Evaluation Theory, and Organismic Integration Theory.

Basic Psychological Needs Theory frames this study’s inquiry into how youth perceive the Odyssey of the Mind context as satisfying three basic psychological needs (competence, autonomy, and relatedness) and whether “need satisfaction” (or “need frustration”) relates to creative performance. Next, Cognitive Evaluation Theory and finally Organismic Integration Theory combine to offer an expanded notion of the types of motivation youth perceive themselves to have experienced in the Odyssey of the Mind context (e.g., from autonomous to controlled). Due to its nuanced explication of motivation, self-determination theory provides a useful structure for examining why adolescents may pursue creative endeavors, engage in creative processes, and perform creatively.

**Intrinsic Motivation Principle of Creativity Overview.** The Intrinsic Motivation Principle of Creativity appears to be influenced by early iterations of self-determination theory (Deci & Ryan, 1985; Deci & Ryan, 2000; Hennessey, 2019; Ryan & Deci, 2017). Building upon her earlier psychometric work, Teresa Amabile (1983, 1996) developed a “componential model of creative performance” derived from tenets of social psychology that explains creativity as influenced by the interaction of *domain-relevant skills*, *creativity-relevant processes*, and *task motivation*. Within this theory, creativity is defined as a product (including ideas or artifacts) that a panel of suitable judges reliably and consensually agree is novel and appropriate for the product’s domain. Domain-relevant skills refer to those areas in which an individual could be creative depending upon an individual’s knowledge of the domain, technical skills, and domain-relevant “talent.” Creativity-relevant processes include three factors: *cognitive style* (e.g., resistance to functional fixedness, divergent thinking, keeping response options open during
problem-solving, etc.), knowledge of heuristics for generating novel ideas (e.g., implicit and explicit strategies to produce novelty), and a conducive work style (e.g., concentrated effort, persistence, “productive forgetting,” etc.) (Amabile, 1996, p. 88).

These processes depend on training, experience in idea generation, and personality characteristics. Lastly, Amabile (1996) describes “task motivation” as a key component of creative production. Task motivation includes attitudes an individual brings toward the performance of a task and perceptions of one’s motivation for undertaking the task. Research investigating the link of task motivation to creative production has found that intrinsic motivation is the most conducive to creativity, which has come to be known as the Intrinsic Motivation Principle of Creativity (Amabile, 1983; 1996).

Need Supportive Contexts. Contextual factors that support the satisfaction of basic psychological needs for competence, autonomy, and relatedness contribute to intrinsic motivation (Deci & Ryan, 2000; Ryan & Deci, 2017). Since intrinsic motivation is thought to be the most conducive to creativity, examinations of contexts that may be considered “need supportive” (fostering competence, autonomy and relatedness) are likely to have practical implications for motivation to engage creative processes (Amabile, 1996; Reeve, 2006; Stroet et al., 2013). Since perceived need satisfaction is likely contingent on the roles of adults and peers in the Odyssey of the Mind context, research on need-supportive environments offers a useful guide for examining contextual factors that may affect adolescent creativity. Youth perceptions of their needs being satisfied (or frustrated) may nurture creativity.

Taken altogether, an integration of the Intrinsic Motivation Principle of Creativity (Amabile, 1983;1996) and Self-Determination Theory (Deci & Ryan, 2000; Ryan & Deci, 2017) directed the formation of the research questions. These theoretical frameworks combined with
findings from the need-supportive contexts literature (Reeve, 2006; Stroet et al., 2013) framed the subsequent analyses of the current study.

**Purpose of the Current Study**

The principal purpose of the current study was to extend the current understanding of how motivation relates to creativity during adolescence. Specifically, there were four main aims of the present study within the Odyssey of the Mind context:

1. To assess the levels of need satisfaction (competence, autonomy and relatedness) and need frustration (competence, autonomy and relatedness) perceived by early adolescent youth in a specific out-of-school context.

2. To examine associations among perceived need satisfaction and frustration with types of motivation to engage in creative processes (from more autonomous or self-determined to more controlled).

3. To examine associations between early adolescents’ perceived need satisfaction (and perceived need frustration) with verbal divergent thinking (fluency and originality), a measure of creative potential.

4. To examine associations between different types of motivation to engage in creative processes (from more autonomous or self-determined to more controlled) with verbal divergent thinking (fluency and originality).

**Definition of Key Terms**

**Early Adolescence.** Early adolescence (10- to 15- years old) is defined as a distinct period in human development characterized by interrelated changes in cognitive, physical, and socioemotional development (Blakemore & Mills, 2014; Caskey & Anfara, 2007). According to the World Health Organization, experiences in early adolescence can have lasting effects on the
well-being of individuals globally and more efforts are needed to study factors that may thwart the optional functioning of youth in this developmental period (Lane, Brundage, & Kreinin, 2017).

**Odyssey of the Mind.** The Odyssey of the Mind (OM) program is defined as the context for the study. Odyssey of the Mind is an extracurricular program designed specifically to promote creative thinking and self-direction among youth. Over a six-month period, youth in groups of five to seven work together to design a creative solution to one of five “long-term” problems as well as to demonstrate original thinking during an improvisational, “spontaneous” performance (Creative Competitions, Inc., 2018).

**Need Satisfaction and Frustration.** Self-determination theory posits that humans require three basic psychological needs to be satisfied in order for behavior to be self-determined (Self-Determination Theory; Deci & Ryan, 2000; Ryan & Deci, 2017). These include autonomy (to feel that one’s actions are done with volition), relatedness (to experience intimacy and connection with others) and the need for competence (to feel capable and efficacious). Need satisfaction is defined as “a necessary condition for human thriving or flourishing” and “need frustration is injurious to well-being” (Chen et al., 2015; Ryan & Deci, 2017, p. 242).

**Motivation.** In the present study, youth are asked to examine the extent to which they engage in creative processes at Odyssey of the Mind for intrinsic purposes such as enjoyment and interest or for other extrinsic reasons such as compliance, rewards, valuing other aspects of the experience, etc. According to Self-Determination Theory, intrinsic motivation is defined as “the doing of an activity for its inherent satisfactions rather than for some separable consequence” (Ryan & Deci, 2000, p. 56). *Intrinsic motivation* is measured by questions that focus on enjoyment (e.g., “I participate in Odyssey of the Mind because it’s fun”) and interest
Motivation that originates extrinsic to the individual includes the following types (from more controlled to more autonomous):

1. **External** - “I participate in Odyssey of the Mind because that’s what I’m supposed to do” or “I help to make creative solutions because I want the coach to say nice things about me”.

2. **Introjected** - “I participate in Odyssey of the Mind because I want the coach to think I am a good student” or “I help make creative solutions in Odyssey of the Mind because I feel ashamed of myself when I don’t try.

3. **Identified** - “I try to do well because it’s important to me to work on the creative solutions at Odyssey of the Mind” or “I try to help create solutions because I want to learn new things”.

A fourth regulatory type, **integrated**, has been hypothesized to be on the motivation continuum; however, recent research has found that it is conceptually difficult to distinguish from identified and intrinsic motivation (Howard, Gagné & Bureau, 2017). Due to this lack of conceptual clarity, integrated regulation was not utilized in the present study.

**Creativity.** Although many scholars argue the finer points of a definition for creativity, there is consensus in the field that “novelty” or “originality” as well as “usefulness” are key requirements for creative ideas or products (DeDreu et al., 2017; Runco & Jaeger, 2012). Some scholars have espoused the need to differentiate degrees or “magnitudes” of creativity, such as “little-c” (personal, mental processes that result in novel ideas) and “Big-C” (processes, ideas, or products that are consensually agreed upon to be creative by more than one person) (Kaufman &
Beghetto, 2009; Simonton, 2017). Smith and Smith (2017) argued that a focus on creative products distracts from the elemental nature of the construct; instead, they argue that creativity should be conceptualized simply as a mental process.

For the present study, creativity was viewed as an important mental process that results in the development of novel ideas and products. It is through the process of creation – of developing original ideas and products -- that adolescent youth may experience psychological benefits (Tamlin, DeYoung, & Silvia, 2016).

**Divergent Thinking.** Divergent thinking (DT) is an important micro-process for creativity and is based on Guilford’s (1956, 1985, 1988) Structure of Intellect (SOI) model of intelligence (Ward & Kolomyts, 2010). According to Guilford, divergent thinking is the cognitive act of generating many possible responses to an ill-defined problem or question (Plucker et al., 2004; Starko, 2014). Typically, divergent thinking tasks have been designed to measure individual differences in domain-specific creative abilities, also known as “creative potential,” a term used in creativity research to show the predictive validity of divergent thinking as an antecedent for creative achievements (Runco, 2004; Silvia, Martin, & Nusbaum, 2009).

Four facets of divergent thinking are frequently mentioned in the literature: fluency (the number of responses given to a problem), originality (the statistical infrequency of a given response), flexibility (the change in category from one response to the next), and elaboration (details added to given responses to extend ideas); however, typically research using divergent thinking tasks focuses primarily on originality as the key facet (Guilford, 1967; Kaufman, Plucker & Baer, 2008; Runco, 2010).
Research Questions

1. What are the perceptions of need satisfaction (autonomy, relatedness, and competence) and need frustration (autonomy, relatedness, and competence) among early adolescent youth participating in the Odyssey of the Mind context?

2. How do perceptions of need satisfaction (autonomy, relatedness, and competence) and perceptions of need frustration (autonomy, relatedness, and competence) relate to motivation (external, introjected, identified, and intrinsic) to engage in creative processes among early adolescent youth participating in the Odyssey of the Mind context?

3. How do perceptions of need satisfaction (autonomy, relatedness, and competence) and perceptions of need frustration (autonomy, relatedness, and competence) relate to verbal divergent thinking (fluency and originality) among early adolescent youth participating in the Odyssey of the Mind context?

4. How does motivation (external, introjected, identified, and intrinsic) to engage in creative processes at Odyssey of the Mind relate to verbal divergent thinking (fluency and originality)?

Research Hypotheses

RQ1 Hypotheses. Odyssey of the Mind may be a unique developmental context for satisfying the basic psychological needs (competence, autonomy, and relatedness) of adolescent youth. Odyssey of the Mind has been designed to support all three needs (competence, autonomy, and relatedness). Youth work in small teams to produce a novel solution to a long-term problem without constraints placed upon them by teachers or coaches; however, they are supported in developing skills and finding resources to compete the task.
Creative competence is supported when youth develop domain-relevant and creativity-relevant skills (Amabile, 1996) over the duration of the program at the behest of the youth (e.g., researching relevant content, learning to sew, building, etc.). Autonomy is supported in the Odyssey of the Mind context because freedom and choice in the development of the products is a central facet of the Odyssey of the Mind program design.

Finally, relatedness is cultivated in the Odyssey of the Mind context by the coaches who are trained to build cooperation and collaboration. Although encouraging teamwork may not result in youth feeling a sense of belonging, Odyssey of the Mind contexts that promote teamwork could mitigate potential feelings of exclusion that some youth may feel if individual ideas are not adopted in the development of the team’s solution to the “long-term” problem. For example, youth must work together to design the final product for the competition, and not all ideas generated by individuals are ultimately incorporated into the final product. Contexts in which teams are supported in developing teamwork skills may be more need-supportive than those contexts that do not intentionally nurture teamwork and collaboration.

Basic psychological needs for autonomy, relatedness, and competence may be undermined in the Odyssey of the Mind environment as well. Since coaches vary in experience working with youth (e.g., experienced teachers to novice volunteers), the extent to which primary tenets of the Odyssey of the Mind coaches’ training are understood and operationalized by adults working with the youth is variable. If coaches interfere too much in the development of the creative solutions (autonomy frustration), fail to provide informational feedback and consistent learning opportunities that promote skills development (competence frustration) or if the coaches or peers are inequitable in their treatment of each team member (relatedness
frustration), needs could be thwarted, and youth may experience the Odyssey of the Mind context as controlling.

Although the Odyssey of the Mind context may hinder need satisfaction for some students, it is hypothesized that the structural aspects of the program are followed with fidelity to the program’s intentions and as such will ensure a need-supportive context for most participating youth. Therefore, due to the nature of the Odyssey of the Mind context, it is anticipated that adolescents would report higher degrees of need satisfaction than of need frustration.

**RQ2 Hypotheses.** Since need satisfaction and need frustration have been shown to influence intrinsic motivation in a number of different contexts, it was hypothesized that a similar pattern of association would be found in the Odyssey of the Mind context. It was expected that perceived satisfaction for the needs of autonomy, relatedness, and competence would be more strongly related to higher degrees of internalization; whereas, perceived need frustration would be more related to externalization (Deci & Ryan, 2000; Ryan & Deci, 2017).

**RQ3 Hypotheses.** The association of need satisfaction to individual creativity as expressed through divergent thinking in the verbal domain (creative ideas presented in words rather than pictures) has not been examined in previous research. Although it is possible that need satisfaction is unrelated to creative processes, it is likely that teams that regularly practice “spontaneous thinking” games -- many of which originated from divergent thinking tasks developed by psychological researchers in the mid 20th century – would experience the Odyssey of the Mind context as supporting competence in creative thinking, especially in the verbal domain.

In Odyssey of the Mind, youth are expected to be able to generate novel and useful responses to a verbal divergent thinking task developed by the Odyssey of the Mind program
administration (e.g., “Use a word or words to make a first and last name. You must relate this name to an occupation; for example, Minnie Ster is a clergyman. Clare E. Nette is a musician”). Responses are scored as either “creative” or “common” by the trained judges. Youth are expected to demonstrate an ability to generate novel responses to this task during an improvisational performance at the culminating Odyssey of the Mind competition, which takes place after several months of practice.

When youth are supported in the development of this “creativity-relevant skill” (Amabile, 1996), it is hypothesized that the need for competence is satisfied. Thus, it was expected that competence satisfaction would positively relate to verbal divergent thinking. Although a positive correlation was expected, the strength of the association is uncertain due to lack of \textit{a priori} evidence. Conversely, it was expected that if youth perceive the Odyssey of the Mind context as unsupportive in developing competence in verbal divergent thinking (e.g., not practicing spontaneous thinking strategies or not evaluating “creative” from “common” responses), youth may not only perceive the context as not satisfying the need for competence but by actively frustrating the need. Thus, the relations of perceived need satisfaction (competence, autonomy, and relatedness) was be examined in relation to verbal divergent thinking, a measure of individual creative performance.

Need satisfaction is argued to be contingent upon a balance of each need (Niemec & Sheldon, 2006); however, it is unclear if balanced need satisfaction is required for youth to exhibit creative thinking. Youth working in small teams during Odyssey of the Mind is a contextual characteristic that could possibly influence the development of creative thinking for early adolescents who are developmentally sensitive to peer influences (Blakemore & Mills, 2014). Generating creative ideas in a group is an iterative learning process (Sawyer, 2019). As
such, this social aspect of the context would most likely contribute more to competence satisfaction and relatedness satisfaction than to autonomy satisfaction. Though all three needs are thought to be necessary antecedents for intrinsic motivation, it is unclear how autonomy satisfaction (or frustration) and relatedness satisfaction (or frustration) relate directly to the production of original ideas within the verbal domain at the individual level. Thus, no specific associations are hypothesized as these investigations are exploratory in nature.

**RQ4 Hypotheses.** A meta-analysis examining the association between intrinsic motivation and creative products (e.g., ideas) revealed a positive effect size ($r = .30, p < .001$) with type of research design (i.e., cross-sectional or causality-oriented) as moderating the association (de Jesus et al., 2013). Additionally, Ceci and Kuman (2016) found significant positive correlations of creativity to intrinsic motivation (enjoyment and challenge) ($r = .36, p < .001$). Given this, it was expected that youth would report high levels of intrinsic motivation to engage in creative processes within the Odyssey of the Mind. For example, when asked why youth try to develop creative solutions to the Odyssey of the Mind problems, it was expected that youth would report that the process is “fun” and “enjoyable” at high response rates. The degree to which other types of motivation (identified, introjected, and external) are related to creative ideation (verbal divergent thinking) is not established; therefore, no hypotheses about the direction or strength of associations are predicted.

**Contributions to the Literature**

There has been a recent resurgence in the examination of creativity development during adolescence among researchers (Barbot & Heuser, 2017). Research has focused primarily on developmental trajectories of creative cognition during adolescence (Kleibeuker, DeDreu, & Crone, 2016) and upon cultivating creativity in middle school classrooms (Beghetto, 2006,
Less is known about how engagement in creative processes may satisfy basic psychological needs of adolescent youth, foster intrinsic motivation for creative endeavors, and influence creative thinking, especially in out-of-school contexts. This study examined Odyssey of the Mind, an out-of-school context specifically designed for adolescent youth to engage in creative processes. The extent to which and ways that youth perceived Odyssey of the Mind as an experience that satisfied basic psychological needs for autonomy, relatedness, and competence has both theoretical and practical implications for the development of creativity during adolescence.

Although few research studies have employed Self-Determination Theory as a guiding framework to investigate contextual factors related to the development of creative thinking and behavior (Hennessey, 2010; 2019), the present study was designed upon the premise that satisfaction of basic psychological needs for competence, autonomy, and relatedness are key facets of intrinsic motivation for all human beings and that intrinsic motivation is the fuel for creative thinking and behaviors. Examining how creativity is supported or hindered in particular contexts and specific to early adolescence builds on the premises expressed in the revised Intrinsic Motivation Principle of Creativity (Amabile, 1983, 1996), which, taken together, offers an integrated framework for use in examining development of creativity over time.
Chapter II: Review of the Literature

This chapter reviews extant literature and provides a rationale for the examination of the motivation to engage in creative processes that early adolescent youth may experience within an out-of-school context and the ways in which these motivations are related to verbal creative thinking. This review begins with an overview how creativity has been conceptualized and situated within changing trends in research paradigms. Next, a brief review of research findings from developmental perspectives on creativity will be presented. How creativity is measured will be reviewed followed by a special focus on divergent thinking as a key indicator of creative potential. Following the review of research on creativity development in early adolescence, two key theoretical frameworks guiding this study’s understanding of motivation will be presented followed by a review of research employing these frameworks. Finally, this review will describe need-supportive practices for supporting intrinsic motivation and creativity.

Defining Creativity

Theoretical perspectives about the nature of creativity are diverse and can cause empirical research to seem fragmented rather than integrated (Batey, 2012; Silvia et al., 2016; Sternberg & Kaufman, 2010). An active area of disagreement among researchers is how to best capture the multifaceted qualities of creativity in research designs. Scholars continue to debate how many criteria should be included in a core definition of creativity (Simonton, 2017) despite over six decades of work to build consensus (Barron, 1955; Guilford, 1950; Runco, 2004; Kaufman, 2016). In fact, most creativity researchers have adopted what Runco and Jaeger’s (2012) coined “the standard definition of creativity,” an articulation of creativity as a representation of
something “novel” (new, different, or innovation) and “useful” (appropriate to the task) over
other qualities in creative production. Other qualities might include “high-quality” (Sternberg,
Kaufman, & Pretz, 2002) or “surprising” (Simonton, 2012) or culturally dependent (Kharkhurin,
2014). Scholars question the extent to which the use of two criteria in defining creativity mimics
actual ways people evaluate the what they consider to be creative (Acar et al., 2017) or the extent
to which the dimensionality of the construct is ignored (Kaufman & Sternberg, 2010; Simonton,
2012). Despite concerns of conceptual clarity, novelty and usefulness continue to be modeled as
key attributes of creativity. Recent research, however, has explored which of the two attributes
contributes more to a valid conceptualization of creativity in real-world contexts (Acar et al.,
2017; Diedrich et al., 2015).

For example, Diedrich, Benedek, Jauk, and Neubauer (2015) examined how individuals
weight novelty and usefulness during idea evaluation. The researchers asked 18 non-expert
judges with no training in creativity to evaluate ideas produced by 1,500 seventh graders from
responses on both verbal and figural divergent thinking tasks. The judges were given the criteria
of novelty, usefulness, and creativity. Interrater reliabilities ranging between .73 and .87
demonstrated reasonably consistent evaluations across the judges. Although both were found to
be significant, novelty was found to be a stronger predictor of ideas that were rated as “creative”
than did usefulness.

Recently, building off of the work of Diedrich et al. (2015), Acar, Burnett, and Cabra
(2017) investigated what and how many factors should constitute creativity using the definition
from the U.S. Patent Office (originality, value, surprise) with an addition of aesthetics as another
hypothetically important facet. Patents are a common indicator of “professional creativity”
(Kaufman & Beghetto, 2009; Simonton, 2012). These four attributes were examined in relation
to three types of creative outputs (ideas, everyday products, and socially recognized products). Findings supported a growing consensus in the field that originality is the strongest predictor accounting for unique variance in the following ways (all $ps < .001$):

- 36% - 48% in socially recognized creative products
- 42 - 58% in creative everyday products
- 51% - 59% in creative ideas

While originality was a strong predictor, surprise explained “1% to 9% in socially recognized creative products, 0–8% in everyday creative products, and 0–5% in creative ideas” (Acar et al., 2017). Additionally, “value explained 2% to 5% in socially recognized creative products, 1–4% in everyday creative products, and 2% to 9% in creative ideas. Aesthetics explained 1–2% in socially recognized creative products, 0% to 4% in everyday creative products, and 0–3% in creative ideas” (Acar et al., 2017). The researchers found that the quality of “surprise” explained a significant amount of variance in creativity above and beyond originality and value ($\beta$s = .21), a finding that maintains the three-dimensional Patent Office definition. Aesthetics was also significantly related to creativity in all types of outputs.

Such controversy is fundamentally related to beliefs and implicit theories about the nature of creativity (Hass et al., 2016; Karwowski, 2014). Is creativity a personality trait? A process or a product? Something distinct from intelligence? Best measured objectively or subjectively? Rather than dismissing such questions as confounding, Glăveanu and Beghetto (2017) called for theorists and researchers to adopt a “polyocular” lens during inquiry for a more integrated understanding of creativity as a phenomenon. One of the purposes of the present study is to examine how engagement in creative processes that are part of the Odyssey of the Mind program...
may satisfy the basic psychological needs of youth to feel competent, autonomous, and a sense of belonging.

As such, this review examined creativity as process resulting from an interaction of individual abilities and environmental influences that results in the production of novel or original work (Amabile, 1996; Barbot, Lubart, & Besançon, 2016; Mumford, 2003; Plucker et al., 2004; Sternberg & Lubart, 1995).

**Creativity Development During Early Adolescence**

Much previous work on creativity development across the lifespan has focused on identifying antecedents at the cognitive level that result in a person’s capacity to generate original solutions to problems or to craft socially validated creative works. Associated outcomes derived from engagement in creative processes are less known. Although creativity researchers have yet to propose a metatheory explaining how creative thinking and behavior develop across the lifespan, most developmental approaches tend to focus on childhood and adulthood with fewer focused on adolescence (Barbot & Heuser, 2017).

Early adolescence is a pivotal time to examine the development of cognitive abilities (Reyna, 2012; Furmann et al., 2015), particularly with regard to the microprocesses required of creativity such as cognitive flexibility and divergent thinking (Amabile, 1996; Kleibeuker, De Dreu, & Crone, 2016; Russ & Fiorelli, 2010). Creative thinking is a primary cognitive function that relies upon working memory and executive control (Nijstad, De Dreu, Rietzschel & Baas, 2010). Findings from neuroscientific approaches to the study of creativity and brain function have provided structural evidence that creative performance is dependent upon a “dual pathway model” (De Dreu, Baas, & Nijstad, 2008) also known as the “controlled-attention theory of creativity” (Beaty et al., 2014). Within this view, the cognitive processes that result in creative
ideas starts with a person’s capacity to generate many ideas in a relatively short time period (e.g., associative processing) followed by a purposeful analysis of the generated ideas (e.g., logical processing) to select ideas with high novelty or originality (Beaty et al., 2014; Beaty et al., 2016; De Dreu, Baas, & Nijstad, 2008; Vartanian, 2016). From this model, youth who come up with creative ideas are likely to demonstrate cognitive flexibility and cognitive persistence. The extent to which early adolescent youth produce creative ideas may depend on the different weights of cognitive flexibility and cognitive persistence expended per task (Amabile, 1996; Kleibeuker et al., 2016), developed within specific domains (Amabile, 1996; Baer, 2016), and per stage of adolescence (Barbot, Lubart, & Besançon, 2016; Charles & Runco, 2001; Kleibeuker et al., 2013; Russ & Fiorelli, 2010; Torrance, 1968).

For example, Kleibeuker, De Dreu, and Clone (2013) examined the development of divergent thinking and insight as cognitive functions signifying a person’s potential to produce creative ideas ($N = 98$). Using a cross-sectional research design and testing for age differences, the authors found that the capacity to generate multiple ideas (fluency) from different conceptual categories (flexibility) in response to verbal divergent thinking tasks (i.e., typical measures of creative thinking) is already developed by ages 12-13, but the originality of ideas continues to develop until ages 15-16. After which, originality appears to decline among older participants. A different developmental pattern emerged when the authors examined performance on a task designed to elicit creativity (i.e., originality) in the visuospatial domain, finding that middle adolescents performed with higher cognitive flexibility. When the researchers measured insight, a cognitive process that requires convergent thinking rather than divergent thinking, a new curvilinear developmental pattern emerged. Performance on the insight tasks generally improved as age of participant increased, suggesting differential patterns of developmental trajectories.
depending on task and domain as well as stage of adolescence. These findings exemplify the notion that creativity development is marked by “peaks” and “slumps” which has been empirically demonstrated in the literature (Barbot et al., 2014; Russ & Fiorelli, 2010; Tinio & Barbot, 2017; Torrance, 1968).

This line of developmental inquiry has its roots in Torrance’s (1968) seminal longitudinal study which found what appeared to be a “fourth grade slump” in originality of ideas occurring around the age of nine. Torrance conducted psychometric research from 1958 to 1964 with 350 students in grades one through six to identify general cognitive abilities related to adult creative achievement and for the purpose of developing a standardized test of creative thinking abilities that could be administered to individuals across the lifespan (Cramond et al., 2005; Russ & Fiorelli, 2010). In subsequent follow-up studies with the remaining 100 original participants, Torrance (1981) tested the predictive validity of these Torrance Test of Creative Thinking (TTCT) scales. As a result, Torrance (1967, 1968) found that a majority of participants’ scores dropped by approximately a one-half standard deviation across four aspects of creative thinking (fluency, flexibility, originality, and elaboration) over time.

A more recent study carried out by Kim (2011) found that visuospatial creative thinking measured through the Torrance Test of Creative Thinking (TTCT) scales had decreased from 1990 to 2008. The largest decrease in fluency scores was for kindergartners through third graders, and the second largest decrease was for fourth through sixth graders. Originality scores remained static from 1998 to 2008, and interestingly, “resistance to premature closure,” an aspect of the TTCT that estimates the extent to which respondents resist functional fixedness (i.e., a cognitive bias that confines a person to see stimuli in a singular way) when generating original
ideas, increased among early adolescent youth. The ability to resist this cognitive bias during idea generation is a creativity-relevant skill (Amabile, 1996).

Current scholars have sought to understand the phenomena related to observed slumps and peaks in creativity development. Kaufman and Beghetto (2009) presented a “Four C Model” of creativity to account for qualitative differences across hypothesized stages along a continuum of creativity development (e.g., “little-c” also known as “everyday creativity” to “Big-C” which refer to creative works of eminence) that could be used theoretically to examine developmental trajectories of creativity. However, there is some disagreement as to these proposed categories. Runco (2014, 2016) contended that segmenting creativity into discrete types ignores the variability implicit in the continuous aspects of creativity development, pointing to weak empirical support for stage models.

One useful approach for examining the role of context on creativity development during early adolescence relies on a “goodness of fit” between the youth and the environment (Runco, 2001). Similarly, Barbot, Lubart, and Besançon (2016) proposed an “optimal-fit view of creative potential” which interprets variability in development of creativity in light of conceptual and measurement questions. In this view, individual differences in creativity result from the interaction of person-level resources (e.g., motivation), task-specific demands (e.g., not all tasks measure creative potential equally), and environmental influences (e.g., competition, school climate, etc.) (Barbot et al., 2014). The present study is informed by Amabile’s (1996) thoroughly articulated componential framework of how motivational processes relate to creativity during early adolescence. In the following sections, an overview of Amabile’s (1996) Intrinsic Motivation Principle of Creativity will be presented followed by findings from
empirical research that demonstrate what is known about the intersection of motivation and creativity during early adolescence.

**Intrinsic Motivation Principle of Creativity**

The componential theory of creativity put forth by Amabile (1983;1996) suggests that three domains influence creative production: task motivation, domain-relevant skills, and creativity-relevant processes. According to Amabile (1996) intrinsic motivation is the key determinant of whether someone will produce something creative although domain-relevant skills (i.e., technical and specific) and creativity-relevant skills (i.e., cognitive styles that tolerate originality and exploration) are necessary as well (Runco, 2014).

![Componential Model of Creativity](Amabile, 1998, p.78)

In this model, the first of the three components are “domain-relevant skills” (Amabile, 1983; 1996; 1998). Domain-relevant skills delineate the area in which an individual could be creative and are dependent upon an individual’s knowledge of the domain, technical skills, and domain-relevant “talent,” (e.g., natural propensity for vivid mental imagery in writing, facility for finding “perfect pitch” in music, ability to build constructions in engineering, etc.). Amabile
(1996) describes such domain-specific knowledge as a blend of cognitive abilities, perceptual and motor skills, and both formal and informal educational experiences.

The second component is “creativity-relevant processes” and draws upon information-processing theory of cognitive development. Creativity-relevant processes include three factors: cognitive style (e.g., resistance to functional fixedness, divergent thinking, keeping response options open during problem-solving, etc.), knowledge of heuristics for generating novel ideas (e.g., implicit and explicit strategies to produce novelty), and a conducive work style (e.g., concentrated effort, persistence, “productive forgetting,” etc.) (Amabile, 1996, p. 88). These processes depend on training, experience in idea generation, and personality characteristics.

Finally, and most important, Amabile (1996) describes “task motivation” as the third component of creative production; it includes attitudes an individual brings toward the performance of a task and perceptions of one’s motivation for undertaking the task. These factors are dependent on one’s initial level of intrinsic motivation toward the task, a presence or absence of extrinsic constraints (e.g., factors that are either controlling or perceived to be controlling the individual’s performance), and an individual’s ability to rationally minimize extrinsic constraints.

According to Amabile (1996), the focus on task motivation is what distinguishes the componential model from preceding conceptualizations of creativity that focused mostly on domain-relevant and creativity-relevant skills. Specifically, the theory espouses the view that task motivation that is intrinsic (i.e., originating from an inherent drive) is most conducive to creativity. This is known as the Intrinsic Motivation Principle of Creativity (IMPC; Amabile, 1983; 1996) and is based on an assumption that extrinsic and intrinsic sources of motivation are likely to work in opposition to one another. Therefore, behaviors which are not intrinsically
motivated must by default be extrinsically motivated. Most research examining the relationship of creativity to motivation has adopted this operationalization of motivation, and as such, the theory has been strengthened over time through replication of findings (Auger & Woodman, 2016; Grant & Berry, 2011; Shalley et al., 2004).

Within this tradition, most research has demonstrated a positive relationship of intrinsic motivation and a negative relationship of extrinsic motivation to creativity (Auger & Woodman, 2016; Hennessey, 2010). However, a small number of studies have found that extrinsic motivation is not detrimental to creative production (Eisenberger & Aselage, 2009; Eisenberger & Byron, 2011). Amabile (1996) cited findings about the strong effect of intrinsic motivation found across multiple studies as well as the theoretical advances outlined by researchers Edward Deci and Richard Ryan (1985) as cause for revision to the Intrinsic Motivation Principle of Creativity to acknowledge that extrinsically motivated behaviors are not uniformly detrimental to creative production, especially if intrinsic motivation is also high. When external motivators are perceived as informational rather than as controlling, creative performance can sometimes be either unaffected or enhanced (e.g. “reward and recognition for creative ideas,” “clearly defined overall goals,” “frequent constructive feedback”) (Amabile, 1996, p. 117).

Additionally, the intrinsic motivation principle has implications for creativity-relevant skills development. Despite criticism that psychometric approaches to examining creative processes may not capture the wider breadth of phenomena likely to take place when an individual creates something “novel and useful,” divergent thinking tasks have consistently been used to identify individual differences in creative performance and are often referred to as measures of “creative potential” (Amabile, 1996; Paek & Runco, 2018; Runco, 2010). Contexts that specifically train youth to generate and evaluate divergent thinking may create an
environment in which repeated exposure and rehearsal of these creativity-relevant microprocesses may affect the degree to which youth become intrinsically motivated through deliberate, focused, and effortful engagement in creative thinking and behavior (Tinio & Barbot, 2017). Research describing factors related to individual differences in creativity (i.e., person-level resources) associated with creativity among adolescent youth are presented next.

**Individual Differences in Creativity**

Creativity research tends to focus on antecedents of creative thinking rather than on outcomes associated with creative thinking and behaviors. Individual differences in creativity are typically examined in terms of person-level resources (Barbot et al., 2014), such as cognitive abilities (Guilford, 1967; Cassotti et al., 2016; Kleibeuker et al., 2016), personality (Baas, 2013; Ivcevic & Mayer, 2007; Puryear et al., 2017), emotional regulation, affect, and play (Hoffman & Russ, 2016; Russ, 1993), and psychopathology (Baas et al., 2008). Additionally, in recent decades, research on motivation for creativity has extended beyond the intrinsic-extrinsic paradigm initially outlined by Amabile (1983, 1996) to include work on related constructs, such as implicit beliefs about creativity (Sternberg, 1985), creative self-efficacy (Beghetto, 2006), creative mindsets (Hass et al., 2016; Karwowski, 2014) and creative self-esteem (Barbot, 2018).

From these lines of inquiry, two types of person-level resources may have important implications for whether youth are motivated to engage in creative activities: 1) cognitive abilities and 2) personality characteristics.

**Cognitive Abilities.** A number of scholars have written extensively about the role of cognitive abilities in creativity (e.g., Furnham, 2016; Kaufman et al., 2008; Silvia, 2015). Creativity is a part of most theories of intelligence (Guilford, 1967; Kaufman, 2015; Jauk et al., 2014; Sternberg, 1985). In 1950, Guilford’s presidential address to the American Psychological
Association identified a need to examine creativity as distinctive from intelligence. Guilford’s body of work to establish a “Structure of Intellect” (SoI) model of intelligence grew from this call for a new line of inquiry (1957; 1967). Convergent thinking was identified as a cognitive process related to intelligence, and divergent thinking was identified as related to creativity (Silvia, 2015). Subsequent research conducted by Getzels and Jackson (1962) led to an argument in support of these constructs as conceptually distinct despite poor discriminant validity of the tasks (i.e., the creativity tasks tended to correlate strongly with the intelligence tasks). Wallach and Kogan (1965) extended investigations into the associations between intelligence and creativity by improving the assessment of the task responses and by developing a simplified approach that improved discriminant validity such that the correlation between intelligence and creativity was reported as $r = .09$ (confidence interval (CI) [-0.07, 0.25]).

Kim (2005) conducted a meta-analysis of 21 studies involving more than 45,000 participants and using multiple measures of IQ and creativity and found very small correlations ($r = .17$) between measures of intelligence using $(g)$ and creativity (as measured by divergent thinking). However, some scholars argue that this relationship is underestimated due to the narrow conceptualization of intelligence (Silvia, 2008; Silvia, 2015). Additionally, current research examines creative thought as a more expansive phenomenon than divergent thinking alone. Based on Cattell-Horn-Carroll (CHC; 1993) approach to cognitive abilities, latent-variable studies have shown that executive functioning capacities predict performance on divergent thinking tasks (Silvia, 2015). This work distinguishes between a higher-level general intelligence $(g)$, a middle level of cognitive abilities (e.g., fluid, crystallized, and visuospatial intelligences), and a lower level of narrow abilities (e.g., inductive reasoning). Silvia (2008) found that latent fluid intelligence strongly predicted performance on divergent thinking tasks ($\beta = 0.43$) that were
scored using subjective ratings method (a discussion of these measurement issues will be discussed later). Benedek et al. (2013) replicated the study, finding large effects of fluid intelligence on idea originality ($\beta = 0.51$). Current psychometric research is focused on unpacking which executive strategies most strongly correlate to creativity (e.g., Beaty et al., 2014; Benedek et al., 2014; Cassotti et al, 2016) and neuroscientific research aims to provide structural evidence in support of the psychometric findings (Kleibeuker et al., 2013).

**Personality Characteristics.** Personality refers to individual characteristics that represent unique patterns of thinking, feeling and behaving, such as dispositions, interests, attitudes and values (APA, 2019). The study of personality development in adolescence is a relatively new enterprise, with most of the research in this field having been conducted in the last few decades, and research investigating developmental changes in personality dimensions has shown signs that after adolescence extraversion decreases while openness to experience increases, and agreeableness and conscientiousness may follow a curvilinear trend, decreasing in adolescence and increasing in early adulthood (Mlačić & Milas, 2015).

Most researchers working in the area of personality research and creativity agree that the personality factor most associated with creativity is openness to experience, which is one of the “Big 5” on the NEO (Kaufman, 2016). Research has shown that openness to experience is frequently found to have strong associations to a number of creativity-related constructs, such as college student self-reports of engagement in creative activities (Ivcevic & Mayer, 2007), creative identity and self-efficacy (Karwowski & Lebuda, 2015), and verbal creativity (King, McKee-Walker & Broyles, 1996). In some cases, being high in personality dispositions (e.g., openness to experience, extraversion, norm-doubting, etc.) even predicts creative thinking and behavior (Feist, 2017).
Several studies reviewed examined the relationship of personality to adolescent creativity. Hong, Peng and O’Neil (2014) examined relationships among domain-specific creative activities and achievements according to the Neo “Big” Five Inventory of personality traits using confirmatory factor analyses. Results indicated a positive significant relationship of “openness to experience” to music, visual arts, and creative writing but not to any of the STEM domains. Ivcevic and Brackett (2015) found a predictive relationship of openness to experience to creative production using peer nominations; results found mediating effects of persistence and passion identified through teacher nominations. Furthermore, the authors found a moderating effect of emotion regulation on openness that promoting creativity production.

These results are further supported in a study by Kaufman (2013) in which openness to experience was examined to determine which mix of traits (e.g., curiosity, intellectual interests, etc.) related to more nuanced understandings of creative achievement, finding that “intellectual” and “openness” components of the broader openness construct related differently to information processing and thus predicted different forms of creative achievement. In another study using latent class analysis, von Stumm, Chung and Furnham (2011) examined relationships among personality traits, creative ideation and ability (forms of divergent thinking) using the Neo Five-Factor Inventory. Creativity ability, ideation, and achievement were found to be only weakly interconnected. Taken together, this evidence suggests that openness to experience is not only an important personality trait for predicting creativity in adults but is also good for understanding adolescent creativity.

**Self-Determination Theory**

Although cognitive abilities and personality are important person-level contributors to creative thinking during early adolescence, motivation is viewed as the central person-level
variable of interest in the present study. In the following section, three important mini theories from self-determination theory (e.g., basic psychological needs for competence, autonomy, and relatedness as well as intrinsic motivation) which may relate to creativity during early adolescence are discussed.

**Basic Psychological Needs Theory.** Basic Psychological Needs Theory (BPNT) suggests that three basic psychological needs (competence, autonomy, and relatedness) are universal and are important for human flourishing (Self-Determination Theory; Deci & Ryan, 2000; Ryan & Deci, 2017). When a person’s needs are satisfied, research shows positive associations to his or her degree of adjustment; whereas, when needs are thwarted (frustrated), adjustment is negatively affected (Chen et al., 2015). Research suggests that satisfaction of all three basic psychological needs should be balanced for optimal well-being (Sheldon & Niemiec, 2006).

*Competence* refers to feeling capable and efficacious in dealing with whatever is challenging within any context (Deci & Ryan, 2000). The drive to feel competent stems from a need to feel mastery. Competence can be easily thwarted depending on environmental conditions (e.g., challenges are too difficult, negative feedback is frequent, or social comparisons could undermine beliefs in one’s capability). When individuals are prevented from developing mastery, the need for competence is unmet (Ryan & Deci, 2017).

*Autonomy* refers to the need to self-regulate one’s experiences and actions and is associated with the need to feel that one’s decisions are voluntarily made (Deci & Ryan, 2000). Additionally, autonomy should not be conflated with other seemingly related concepts like independence (lack of dependence) because it is possible within Self-Determination Theory for
an individual’s motivation to be autonomous or volitional while still reliant upon others (Ryan & Deci, 2017).

*Relatedness* is sometimes referred to as “belonging” and involves the feeling of being socially attached (Deci & Ryan, 2000). When people report feeling cared for as well as caring for others, the belonging need is met. Thus, relatedness is a matter of relational responsiveness and sensitivity (Ryan & Deci, 2017). According to Self-Determination Theory, people are naturally motivated to achieve well-being (e.g., flourishing, optimal adjustment, wellness, life satisfaction, etc.) when all three basic psychological needs are satisfied (Deci & Ryan, 2000; Ryan & Deci, 2017). Deci and Ryan (2000) refer to this triadic relationship as “organismic integration.”

**Cognitive Evaluation Theory.** Second, another mini theory of Self-Determination Theory, Cognitive Evaluation Theory focuses solely on intrinsic motivation (inherent natural drive for behavior). According to Cognitive Evaluation Theory, when children and adults play, tinker, explore and create, intrinsic motivation is typically driving such behavior (Amabile, 1996; Csikszentmihalyi, 1990). Research using Cognitive Evaluation Theory specifically examines the influence of social contexts on intrinsic motivation (e.g., rewards, controls, feedback, etc.) as well as investigates how supports for competence and autonomy foster intrinsic motivation (Deci & Ryan, 2000; Ryan & Deci, 2017). Specifically, Ryan and Deci (2017) outline five propositions of Cognitive Evaluation Theory:

1. Experiences perceived as stemming from an internal locus of causality will increase feelings of autonomy and therefore foster intrinsic motivation, and likewise, events perceived as promoting an external locus of causality will thwart autonomy and weaken intrinsic motivation,
2. External events will affect intrinsic motivation to the degree that the experience is perceived as influencing a person’s competence, and

3. External events that initiate or regulate behavior may be viewed according to three aspects (informational, controlling, and amotivating), each of which may explain the psychological meaning people place upon their experiences within each context;

4. Interpersonal contexts can be classified by motivational climate (controlling, autonomy supportive, or amotivating) and

5. Intrinsic motivation will be dependent upon intrapersonal factors, such as the degree to which people pressure themselves toward an outcome (e.g., “internally controlling,” or “ego-involvement”).

Collectively, these five propositions of Cognitive Evaluation Theory aide researchers in examining the functional significance of contextual events, interpersonal, and intrapersonal factors on an individual’s intrinsic motivation (Ryan & Deci, 2017).

**Organismic Integration Theory.** Whereas Cognitive Evaluation Theory is concerned specifically with intrinsic motivation, Organismic Integration Theory is concerned with extrinsically motivated behavior (i.e., “instrumental” or done for reasons other than the behavior itself). *External regulation, introjected regulation, identified regulation and integrated regulation* comprise the four extrinsic motivational orientations whereas *intrinsic motivation* defines motives that are fully internalized (see Figure 3; Ryan & Deci, 2017).
The revision of the Intrinsic Motivation Principle of Creativity was initiated by findings from research utilizing Organismic Integration Theory that demonstrated that not all extrinsic motivators have deleterious effects on creativity, and in some cases can serve a special function in the creative process (Amabile, 1996). These “synergistic extrinsic motivators” align to the types of extrinsic motivation described in Organismic Integration Theory that are internally regulated (i.e., identified and integrated).

Together, Cognitive Evaluation Theory and Organismic Integration Theory combine to explain the intrinsic motivation continuum (from controlled to autonomous) with each end of the continuum aligning to an individual’s locus of control (from more externalized to more internalized). When further combined with Intrinsic Motivation Principle of Creativity and Basic Psychological Needs Theory, these theories address effects of social contexts on motivation, highlighting the crucial roles that need satisfaction plays in promoting more internalized, autonomously controlled, self-determined behavior. The extent to which the Odyssey of the
Mind context is perceived to support autonomously controlled motivation is a main aim of this study.

**Individual Differences in Needs Strength.** When needs are met, intrinsic motivation is primed. Interpersonal differences in the strength and types of needs will vary according the unique social learning that arises. Some research suggests that there is variation in how much fulfillment of a need is required in order for the need to be satisfied (Chen et al., 2015). Some people might not need as much relatedness as others, yet they still need some to have their need met. Researchers using self-determination theory as a framework often investigate what influences development and quality of needs strengths (Chen et al., 2015; Sheldon & Niemiec, 2006). However, Ryan and Deci (2017) posit that individual differences in needs strength is neither relevant or reliable for studies of need-related motives (p. 89); rather, individual differences in needs strength are sometimes modeled as a moderator between need satisfaction and the specific outcome variable. As such, it may be efficacious to examine reports of needs strength across developmental trajectories either before or concurrent with research on needs and adolescent creativity.

**Contextual Factors for Need Satisfaction.** According to Self-Determination Theory, factors within social environments contribute to the extent to which basic psychological needs are met. Thus, positive social contexts are characterized as “effectance supportive,” “autonomy supportive,” or “relationally supportive” for competence, autonomy or relatedness, respectively (Ryan & Deci, 2017). Within Self-Determination Theory, social contexts (e.g., peers, teachers, parents, etc.) are posited to have direct and indirect effects on need satisfaction (Ryan & Deci, 2017). When the context involves parents, the following antecedents promote need satisfaction: parental behaviors for autonomy support (e.g., positive feedback, avoiding too much
surveillance), provisions of structure (providing choices), parental involvement (spending time together). When the context is a classroom, teacher behaviors (also parents or coaches) can support autonomy with positive feedback that specifically rewards effort and acknowledges attainment of mastery. Additionally, classrooms that limit anxiety from high stakes testing can promote need satisfaction. Jang, Reeve and Deci (2010) investigated different aspects of teachers’ instructional styles best engaged students to support development of autonomous motivation and found that the combination of autonomy support and structure combined had the greatest effects.

**Autonomous Motivation and Adolescent Creativity**

Ryan and Deci (2000, 2017) and colleagues have identified consistent outcomes associated with both need satisfaction and need frustration. A small number of studies have found relationships of autonomous motivation to adolescent creativity. Although not a longitudinal study, Ren, Li and Zhang (2017) used structural equation modeling and found that autonomous motivation mediated the relationship of adolescent perceptions of parental control on creativity as measured by the Real-life Problem-Solving Test, a divergent thinking task from the Runco Creativity Assessment Battery (rCAB). Autonomous motivation was measured using a Chinese version of the Self-Regulatory Style Questionnaire that required participants to respond to items mapping along the intrinsic-extrinsic motivation continuum, including items developed to examine introjected and identified motivations.

The authors chose to create a composite autonomous motivation score from the more nuanced levels; however, future researchers interested in the differential effects of those motivations would do well to avoid aggregating the data and losing the variability. Nonetheless, notable in Ren et al.’s (2017) findings is the moderated mediation relationship between
autonomous motivation and creativity. Autonomous motivation had a positive effect on creativity when parents were behaviorally controlling (e.g., “My parents require me to ask for permission.”). However, when control was psychological and not behavioral, autonomous motivation did not retain its mediating effects.

Another study found autonomous motivation to be have a moderating effect on creativity among Chinese adolescent youth. Liu, Zhang and Zhang (2013) found that autonomous motivation predicted achievement on four tasks from the Torrance Test for Creative Thinking (TTCT), the most widely used divergent thinking test. Additionally, hierarchical linear regressions showed moderating effects of perceived parental involvement (one of Self-Determination Theory’s contextual factors for autonomy support) depended on grade level. Junior high school students’ level of perceived parental involvement did not make distinctive impacts on either autonomous motivation or creativity; however, for high school students with low parental involvement, higher autonomous motivation promoted adolescent creativity. Although the two previous studies found significant and positive relationships of autonomy supports and creativity, Dai et al. (2012) found no relationships of perceived teacher or parent supports in the development of “creativity-related characteristics” such as curiosity, openness, persistence, etc. Dai et al.’s (2012) inclusion of person-level characteristics hypothesized to be associated with creativity was a strength of the study and a design element aligned to systems-based inquiry.

With the systems approach in mind, this review not only sought to uncover very recent applications of self-determination theory in the investigation of adolescent creativity. Today, a corpus of research evidence is building that supports the role of beliefs about one’s competence to be creative (e.g., creative mindsets and creative self-efficacy) in the development of creative
processes, products and people (Karwowski & Kaufman, 2017). There is a need for theoretical integration of related constructs to better understand how the system as a whole works upon and with adolescent youth and should begin with an attempt to gain conceptual clarity (Beghetto & Sriraman, 2017).

Ryan and Deci (2017) argued that some theories explaining human motivation sometimes underestimate, if not entirely discount, autonomy as a primary driver. For example, the authors claim that Bandura’s (1997) self-efficacy approach was too limiting because it focused too much on competence. They argue that competence alone is insufficient for flourishing, and they argue that Bandura’s (1997) conceptualization of competence did not encapsulate its “organismic” self-organizing nature. Nonetheless, a key premise of Self-Determination Theory is that competence is inextricably linked to identity -- people need to feel volition over what they are successful in attempting. Research indicates that the need to be competent (discussed in terms of creative self-concepts) extends across domains and is a strong source in whether and how youth engage in creative activities (Karwowski, 2015; Karwowski, 2016).

**Need Supportive Teaching**

Based on self-determination theory, “needs supportive teaching” probes how teachers provide support for basic psychological needs and outcomes associated with each dimension and degree of support (Stroet, Opdennakker, & Minnaert, 2013). There are three dimensions of need supportive teaching: *structure* (support for competence), *autonomy support*, and *involvement* (Stroet et al., 2013). For example, to provide autonomy support, teachers allow students choice in their educational experiences, demonstrate respect for student ideas, and show how schoolwork is relevant to students’ lives (Assor et al., 2002). Such examples may help students feel ownership and control in their learning.
To support students’ needs for competence, a teacher may structure learning experiences with the following four components:

1. clarity of expectations for successful learning,
2. guidance and continual monitoring of student progress,
3. encouragement when students feel challenged, and
4. informational feedback to promote active student learning and growth (Reeve, 2006; Stroet et al., 2013).

Finally, teachers who positively affect the need for relatedness show affection, express attunement to student needs, dedicate resources to facilitate connection to the learning environment, and are dependable (Stroet et al., 2013). Perhaps more importantly, teachers who cultivate peer relationships and promote group belongingness are likely to have the greatest impact on satisfaction for belonging (Stroet et al., 2013).

Although types of needs support are not investigated per se in this study, needs supportive teaching offers a useful interpretive tool for this study’s examination of need satisfaction within the Odyssey of the Mind context. Odyssey of the Mind coaches may be considered to have unique motivational styles that can be thought of as more or less influential (categorized as “autonomy supportive” or “controlling”) on a youth’s engagement in Odyssey of the Mind activities (Reeve, 2006).

Adults who cultivate the Odyssey of the Mind experience for youth can facilitate needs supportive environments in a number of ways. For example, when youth recognize the degree to which they “feel a sense of choice and freedom” in the things they undertake, the acknowledgment is an indication their autonomous motivation in the Odyssey of the Mind context. Such an endorsement indirectly suggests the context is “autonomy supportive,” since
coaches and peers are possibly perceived as providing provisions of support or perhaps simply perceived to not be thwarting an adolescent’s perception of autonomy. Additionally, if youth report feeling insecure about their abilities in Odyssey of the Mind or that their attempts to do well in Odyssey of the Mind stem from a desire for a reward, these responses would be indications of competence frustration in the context and an indication of the lack of coach-provided structure.

With these examples in mind, needs supportive teaching informs this study in its articulation of potentially salient factors that promote a “high-quality relationship” between the Odyssey of the Mind coaches and the youth (Reeve, 2006). While Odyssey of the Mind coaching is not the same as formalized classroom teaching, this investigation will use concepts from the need supportive teaching literature to categorize and reflect on ways Odyssey of the Mind coaches may support students’ inner motivational resources. Since the Odyssey of the Mind model requires a high degree of self-directed effort, it may also be important to consider more specifically how coaches nurture the agency youth must take to be fully participatory in the creative processes at Odyssey of the Mind (Reeve and Tseng, 2011; Reeve, 2013).

**Odyssey of the Mind as a Needs-Supportive Context**

Established in 1978, OM began as an outgrowth of Dr. C. Samuel Micklus’ college teaching of industrial design at Rowan University where he challenged his students to solve open-ended problems using creative approaches (Creative Competitions, Inc., 2018). What began as an instructional strategy turned into a global competition for kindergarten through college youth. Today, participating youth work collaboratively in groups comprised of 5-7 members over a 5- to 6-month period to invent an original solution to one of several problems posed by the OM
administrators as well as to create an accompanying presentation. Such tasks require both competence and autonomy for successful completion.

In addition to solving the “long-term” problem in a creative way, OM teams engage in “spontaneous thinking” games over the course of the program that are intended to enhance cognitive flexibility, problem-solving, and creative ideation. Each team’s problem-solving and creative production is showcased at a regional competition each spring where a panel of judges assess the solutions to the “long-term” problems and the creativity exhibited by team members during a “spontaneous thinking” challenge. Judges evaluate both the creative products and the spontaneous thinking for originality and style. High-performing teams advance to a state competition and then to a “world” competition by late May or early June.

Several aspects of the Odyssey of the Mind model may provide a unique, need-supportive environment for development of creativity (i.e., providing supports for competence, autonomy, and relatedness). First, although teams are facilitated by adults, youth are encouraged to be autonomous in their product development. Adults are instructed to allow students freedom in making choices and decisions about the team’s product development. They are discouraged from offering their own ideas toward the creative solution or for “helping” students with their creations. Yet, adults are encouraged to support youth autonomy in decision-making (e.g., prompting autonomous thinking through targeted feedback and asking questions to stimulate problem-solving).

Youth are also supported in their efforts to build competence. Adults are encouraged to provide hands-on instruction for the development of any skills students need to be successful. By providing opportunities for youth to garner new skills not typically covered in traditional classroom environments (e.g., safely using a drill set when building with wood, sewing
costumes, developing storyboards and skits, accessing research sources not typically accessed in public schools, etc.), youth are supported in building competencies in domains other than core academic content areas such as reading and mathematics. Rather, the domain-relevant and creativity-relevant skills articulated in the IMPC (Amabile, 1996) are integrated in OM. As a result, Odyssey of the Mind activities are often seen by students as personally relevant, carrying with each competence-building activity a certain “utility value” for the student (Harackiewicz and Knogler, 2017).

Furthermore, Odyssey of the Mind specifically trains youth on building competence in “spontaneous thinking.” Workshops are held each year for youth to practice generating original ideas in an improvisational way. At the workshops, teams are given several different prompts comprised of “verbal,” “hands-on,” and “combination” tasks. Team members have never been exposed to these tasks and are expected to work together to generate as many original responses as possible in a timed environment. “Spontaneous thinking” judges have been trained to score for originality and to give evaluative feedback to the teams based on both the quality of responses to the prompts and on the effectiveness of their collaboration to generate many ideas (fluency) as well as original ideas. Originality is the central facet of most creativity definitions and is considered the main factor in models of divergent thinking (Plucker, Beghetto & Dow, 2004; Runco & Jaeger, 2014). Thus, the Odyssey of the Mind model may be a unique context for supporting the development of “creative competence.”

The Odyssey of the Mind environment may also satisfy the need for belonging (relatedness). Since Odyssey of the Mind teams are formed with 5-7 youth, adults are encouraged to formally schedule sessions that help teams build a spirit of collaboration and to highlight the strengths each team member brings to the group project. Odyssey of the Mind
teams whose adult facilitators scaffold collaborative learning may be supporting relatedness according to Self-Determination Theory.

Although the adult facilitators are key architects in building a need-supportive Odyssey of the Mind context, peers may also be a critical support for adolescent creativity development. The extent to which team members support each other’s ideas during brainstorming and the way in which youth are included in decision-making could influence how youth perceive the Odyssey of the Mind context as need-supportive or as conducive to developing one’s personal creativity. Even a singular moment of rejection from either adults or peers during the creative process can stifle an adolescent’s motivation to engage in future creative behaviors. Beghetto and Dilley (2016) refer to this phenomenon as “creative mortification” and have found that such events are tied to feelings of shame, internal attributions, fixed ability beliefs.

As a context for promoting creativity development, Odyssey of the Mind has not been examined extensively. Four dissertation studies examined psychological variables within an Odyssey of the Mind context, and no research studies published in academic journals specified the OM context as a significant aspect of the research design. These dissertation studies were published from 1990 to 2000. Perhaps researchers have become more focused on the many similar extracurricular programs across the United States that have more successfully marketed to align with “STEAM” (science, technology, engineering, art, and mathematics) competencies. In the following section, a review of the literature will be presented to demonstrate evidence of validity and reliability for each of the scales chosen for the present study.

**Measurement of Basic Psychological Need Satisfaction and Frustration**

Grounded in Self-Determination Theory, the Basic Psychological Need Satisfaction and Frustration scale was developed to examine the hypothesized connections between needs for
competence, autonomy, and relatedness and outcomes related to psychological well-being (e.g., self-esteem, life satisfaction, vitality) (Deci et al., 2001; Kasser & Ryan, 1999). Research had also demonstrated discriminant validity in the design of a need frustration scale which could be measured as a distinct construct associated with psychological ill-being (e.g., depressive symptoms, Bartholomew et al., 2011).

Building upon previous work by Sheldon et al., (2001), Chen et al. (2015) constructed a 24-item scale (5pt. Likert-type scale with 1 = “Not at all True” to 5 = “Very True”) assessing general need satisfaction and frustration. After scale development and validation, the researchers tested the scale for measurement invariance among people from across four different cultures (U.S., China, Peru, and Belgium) and examined correlations to background variables (e.g., age, family income, health, financial resources) as well as study variables (e.g., need satisfaction, need frustration, need desire, psychological well-being, and life satisfaction). This analysis was followed by the use of structural equation modeling to assess the convergent and discriminant validity among the constructs, finding that satisfaction of each of the three needs yielded a unique positive relation to vitality, an indicator of well-being ($\beta$s = 0.19, 0.22, 0.42 for autonomy, relatedness, and competence, respectively, $p$s < 0.01). In the model testing need frustration as predictors of ill-being (e.g., depressive symptoms), the following unique positive associations were reported ($\beta$s = 0.26, 0.35, 0.17 for autonomy, relatedness, and competence, respectively, $p$s < 0.01).

The authors concluded that the 6-factor model comprising satisfaction and frustration of each of the three needs was the best fit. Internal consistencies for each of the scales across all four cultures ranged from 0.69 to 0.88, demonstrating adequate reliability.
Recent research analyzed the psychometric properties of the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS) in a sample of 297 Chilean university students. A confirmatory factor analysis (CFA) was performed, evaluating the six-factor proposal developed by Chen et al. (2015), and the internal consistency of the scale demonstrated good internal consistency = 0.90 (need satisfaction) and 0.86 (need frustration). Results from the confirmatory factor analysis showed an adequate fit of the model chi-square ($\chi^2$) $gl = 1.75$; comparative fit index (CFI) = 0.92; incremental fit index (IFI) = 0.92; Tucker-Lewis index (TLI) = 0.90; root mean square error of approximation (RMSEA) = 0.05 and standardized root mean square residual (SRMR) $=0.05$ to the data, showing evidences of the validity of the six-factor structure proposed (DelValle et al., 2018).

Despite these results demonstrating validity and reliability, results from the pre-study conducted in 2017 did not yield similar evidence according to indices of overall model fit standards (Hu & Bentler, 1999). To examine the latent constructs of need satisfaction and need frustration, a structural equation model using the PROC CALIS statement in SAS 9.4 was performed, using maximum likelihood estimation. Model 1: Need Satisfaction, $\chi^2$ (df = 51) = 83.29, $p > .00$, $SB\chi^2/df = 1.63$, CFI = .90, SRMR = .09, RMSEA = .09, 90% CI [0.05,0.12].

![Figure 4: Factor Structure for Basic Psychological Needs Satisfaction and Frustration Scale from Pretesting](image)
Model 2: Need Frustration, $\chi^2 (df = 51) = 62.72$, $p > .13$, $SB\chi^2/df = 1.23$, CFI = .96, SRMR = .07, RMSEA = .05, 90% CI [0.00, 0.45]. The path diagram below shows unstandardized factor loadings and latent variable correlations.

One possible reason for the poor model fit could be that the assumption of independence was not considered in the analysis. The pre-study had a small sample size ($n=86$) and respondents completed the questionnaires as members of teams. In each of the previous studies (Chen et al., 2015; Del Valle, 2018), sample sizes ranged from 297 to 1,051 and a nested data structure was not a consideration in the analyses. Despite the poor fit from the pre-study, other evidence reported by Chen et al., (2015) and Del Valle (2018) suggests that use of the Basic Psychological Need Satisfaction and Frustration Scale is appropriate for use in the present study, especially since the methods used in the present study will account for the nested data structure of youth in teams.

**Measurement of Motivation**

Scholars have designed many measures for assessing intrinsic motivation (Choi, 2009; Ryan & Deci, 2017; Vallerand, 1997). Across most studies on creativity, intrinsic motivation has been conceptualized in contrast to extrinsic motivation with little acknowledgement of the fluctuations in degree of internalization or externalization that an individual may experience along a continuum (e.g., Amabile, 1996). Self-determination theory posits that motivation is both domain-specific and lies along a continuum (Deci & Ryan, 2000). The Self-Regulation Questionnaire (Modified SRQ-A; Ryan & Connell, 1989) assesses domain-specific individual differences in types of motivation (also known as motivation regulatory styles). These styles should not be views as stable, person-level “traits” but rather as a somewhat stable representation of a person’s individual difference in motivation within a specific context (e.g., academic, work,
home, etc.). For this reason, the Self-Regulation Questionnaire – Academic version was selected due to its development for late-elementary and middle school children (i.e., early adolescence) and has been modified to the Odyssey of the Mind context (see Appendix H). This modified scale will be used in the present study to examine the degree of internalization along the motivation continuum (e.g., external, introjected, identified, and intrinsic) for engagement in creative processes. This makes it possible to distinguish between different types of motivation and to specify their effects on performance.

**Measurement of Creativity**

For decades, the examinations of creativity have been conducted as a psychometric pursuit of discriminant validity to distinguish the construct from intelligence (Kaufman et al., 2008). Although the controversy about what constitutes creativity is still active today, researchers have developed additional approaches to capturing a broader view of creativity. One way of organizing creativity research (and subsequent measurement models) is through the use of heuristics. An early example of this is Rhodes’ (1961) “4P” model, which separates the creative person, process, product, and press (i.e., environment). Numerous scholars have reviewed the influence of the 4P model across time (Kaufman & Sternberg, 2010; Sawyer, 2006;...
More recently, Batey (2012) proposed a more extensive heuristic for the study of creativity that considers facets appropriate for measurement (see Figure 5).

The creative individual is typically assessed through examination of the individual characteristics of the creator (e.g., intelligence, personality, knowledge, cognitive styles, motivation). Although Amabile’s (1996) model emphasizes the person-level resource of intrinsic motivation as a key determinant of the expression of creativity, creativity itself was typically assessed as a product representing novelty and usefulness. Amabile (1996) developed the Consensual Assessment Technique (CAT) to assess creative products (e.g., poems, paintings, stories, etc.) using subjective ratings from experts. Her work was based on earlier efforts by MacKinnon (1978) to value creative products. The Consensual Assessment Technique emerged in response to perceived needs to categorize degrees of novelty and originality and to establish a mechanism for comparing creativity based on specific criteria (Kaufman et al., 2008). Evidence for reliability of results using the Consensual Assessment Technique has been established in numerous studies.

For example, from an analysis of 21 studies conducted out of her lab, Amabile (1983) found inter-rater reliabilities ranging from 0.72 to 0.93 using the Spearman-Brown prediction formula. In her later work using Cronbach’s coefficient alpha, Amabile (1996) found reliability in the range of .70 -.89. Baer and McKool (2009) argued that the Consensual Assessment Technique is effective because it allows creativity to be assessed in a domain-specific way and that valid measures of creativity must consider domain-specificity rather than domain-generality. In this way, the Consensual Assessment Technique has compelling face validity. For example, to ensure that judges were not rating attributes other than creativity as a matter of validating the use of the Consensual Assessment Technique, Amabile (1983) demonstrated that judges rating
artistic collages could discriminate creativity from technical goodness (r = .13), neatness (r = .26) or expression (r = -.05). Similarly, she found strong positive correlations with other judgments of creativity (e.g., novel use of materials, aesthetic appeal, etc.) with correlations ranging from .43 to .81 depending on the construct.

Assessments of creativity using the Consensual Assessment Technique are normative within the cluster of items being rated; thus, a limitation of this approach is the inability to standardize scores of any kind using this technique. The scores elicited by the raters are estimations of the quality of the creative product and may not really capture the complexity of the creative process. The assumption is that creativity is domain-dependent. Other measures of creativity tend to take a more domain-general view (e.g., creative activity checklists and self-reported measures of personality characteristics). Although the Consensual Assessment Technique is the primary means of assessing creative products, divergent thinking tasks have been the primary means of assessing creative processes at the cognitive level. The Consensual Assessment Technique will be employed in the present study to assess creative ideas from the divergent thinking tasks administered.

**Divergent Thinking.** Divergent thinking (DT) is an important micro-process for creative performance and is based on Guilford’s (1959, 1986, 1988) Structure of Intellect (SOI) model of intelligence (Ward & Kolomyts, 2010) as well as upon Wallach & Kogan’s (1965) work and Torrance’s (1966) Tests of Creative Thinking. These seminal studies helped to establish a case for divergent thinking as a unique indicator of creative potential and to isolate the cognitive processes responsible for creative ideation (i.e., fluency of divergent thinking).

According to Guilford, divergent thinking is the cognitive act of generating many possible responses to an ill-defined problem or question (Plucker et al., 2004; Starko, 2014). Typically,
divergent thinking tasks have been designed to measure individual differences in domain-specific creative abilities, also known as “creative potential,” a term used in creativity research to show the predictive validity of divergent thinking for creative achievements (Runco, 2004; Silvia, Martin & Nusbaum, 2009). Four facets of divergent thinking are frequently mentioned in the literature: fluency (the number of responses given to a problem), originality (the statistical infrequency of a given response), flexibility (the change in category from one response to the next), and elaboration (details added to given responses to extend ideas); however, most research using DT tasks focus primarily on originality as the key facet (Guilford, 1967; Kaufman, Plucker & Baer, 2008; Runco, 2010).

The present study employed six divergent thinking tasks chosen from the what has been known in the field as the “Uses Tasks.” Variations of these tasks have been in use since the early 1960s. In a typical task, people are asked to generate unusual uses for common objects, unusual instances of common concepts, or unusual consequences of hypothetical events. Individual differences in responses among participants may be related to the uniqueness of the stimuli; thus, each task variant should be examined for evidence that it can reliably measure divergent thinking. Current research has focused on improving facets of divergent thinking task administration to improve generalizability (Beaty et al., 2013; Metwaly, 2017; Nusbaum et al., 2014; Silva, 2008; Silvia, 2011).

Departing from the “objective scoring” used by Wallach and Kogan (1965) for the Uses Tasks, Silvia (2008; 2011) found that divergent thinking tasks such as the “uses” types might best be scored by “subjective scoring” techniques since fluency confounds originality scores in large samples and since reliability is often poorly examined in the DT tasks. Additionally, Silvia (2008; 2011) found that adding the requirement of respondents to pick the “top two” most
creative answers they generated reduced the problem of fluency as a confounding factor. By adding this constraint, Silvia was able to isolate the fluency from the originality scores, helping to elucidate the role evaluation plays in generating original ideas.

However, using subjective ratings muddles the task of estimating reliability. Raters must be added as a facet to the model when examining divergent thinking. The scores that come from raters should be not be considered independent; thus, reliability would be skewed since the assumption of independence is not met. The present study used five of the six uses tasks Silvia (2011) uses (not including “unusual uses for a knife” due to school context appropriateness); therefore, the results from his work on latent variable modeling to estimate rater effect contributing to sources of error is central to this study. Silvia estimated reliability with coefficient $H$, known as construct reliability (Hancock & Mueller, 2004) and conducted a confirmatory factor analysis to detect rater-specific variability (i.e., allowing each rater’s residual variances to covary). All models estimated used Mplus 8 with full-information maximum likelihood with robust standard errors. By combining the constraint of “top two” scoring and the method for modeling rater effects, reliabilities for each task improved from a range of 0.59 to 0.79 to a range of 0.64 to 0.90.

Scoring issues are not the only concerns of working with divergent thinking tasks (Runco, 2007). It is unclear from the research the extent to which the stimulus and wording of the task itself is uniquely affecting how an individual may respond. Individual differences in performance on these tasks may not be related to one’s inherent ability to be highly divergent in cognition but rather as a function of that person’s various life experiences. For example, “name as many unusual uses for a newspaper” was excluded from the task set due to the likelihood that
many early adolescent youths either do not read newspapers or do not know what a newspaper is (e.g., youth are digital natives).

**Creative Performance at Odyssey of the Mind.** Although creative performance at the team-level is not under investigation in this study, the term is important to distinguish from “divergent thinking,” an indicator of individual-level creativity. While divergent thinking is a *process* of generating creative ideas, creative performance is related to the perceptible *products* of creative thinking (Runco, 2010). Creative performance is demonstrated by youth at the team-level at the OM competition in their solutions to two problem types: 1) Long-Term Problems and 2) Spontaneous Problems (Creative Competitions, 2018).

First, youth work in teams to develop a creative solution to a “long-term problem” chosen from five options (see Appendix A). Although not explicitly stated in the Odyssey of the Mind Program Guide, the creative performance demonstrated by each Odyssey of the Mind team in their solutions to the Long-Term Problems is assessed by a panel of judges who use a technique similar to the Consensual Assessment Technique developed by Amabile (1983; 1996). This scoring method quantifies agreement among experts or quasi-experts in judging creative products. In the context of this study, the Odyssey of the Mind judges of the creative solutions to the Long-Term Problems use a 1-15 Likert-type scale for assessing the creativity of the Odyssey of the Mind team products.

Second, creative performance is assessed during the Spontaneous Problems component of the competition. Youth are given a set amount of time to respond to a prompt with each team member taking turns to respond. Individuals are not permitted to “pass” in the event they are unable to provide a response. Youth are coached to supply either a common or already-used response when unable to generate a unique response. This practice allows for Odyssey of the
Mind teams to generate as many ideas as possible within the time allotted. Thus, Odyssey of the Mind judges score each team’s creative performance based on fluency (# of total ideas) and originality (# of novel ideas) of responses given. Novel responses are weighted more heavily than common responses. Creative performance is operationally defined as the scores for creativity each Odyssey of the Mind team received on their Long-Term Solutions and Spontaneous Thinking performance.

**Gap Identification**

For over fifty years, norm-referenced scores on the Torrance Test of Creative Thinking have been declining among youth (Kim, 2011) even as strategies to improve creative thinking are uncovered in the research literature each year (Sternberg & Kaufman, 2010). This phenomenon has been termed “the creativity crisis” in mainstream media. Furthermore, the abundance of research demonstrating advances in brain research has compelled nations to investigate neural-level training interventions for creativity in adolescent populations (Kleibeuker et al., 2016). Beghetto (2017) and others have argued that a culture of high stakes testing has impeded creativity development and has resulted at times in “creative mortification” (Beghetto & Dilley, 2016). Such an argument blends well with Self-Determination Theory’s assertion that high stakes testing is need thwarting in its undermining of competence (Ryan & Deci, 2017).

Finally, there is a need to examine creativity from other vantages other than divergent thinking and to consider research designs that position creative behaviors and activities as exogenous variables predicting psychosocial outcomes related to well-being and human flourishing as well as in examining benefits of childhood creativity (Gadja, Kaufman, and Beghetto, 2017; Silvia, Christensen, & Cotter, 2016). The literature search for this study only
yielded a handful of empirical studies explicitly adopting Self-Determination Theory’s conceptualization of autonomous motivation as an individual level variable. Studies showed autonomous motivation to have positive effects on creativity production when social contexts are less than optimum (e.g., low SES school neighborhood or low parental involvement or lacking autonomy supports).
Chapter III: Method

The purpose of this study was to understand how youth perceive a particular developmental context designed to promote creativity and to examine associations among these perceptions. The following chapter details the methods used within the current study. First, the research design is elaborated. Next, the demographic characteristics of participants are provided, and procedures for recruitment and data collection are detailed, followed by a discussion of ethical considerations. Finally, the measures selected for data analyses are aligned to each research question and presented at the end the chapter.

Research Design

Based on the theoretical framework of self-determination theory (Deci & Ryan, 2000; Ryan & Deci, 2017) and the Intrinsic Motivation Principle of Creativity (Amabile, 1983, 1996), the present study employed a nonexperimental, correlational research design to examine relations among basic psychological need satisfaction and frustration (needs for competence, autonomy, and relatedness), types of motivation for engaging in creative processes (i.e., intrinsic, identified, introjected, and external), and verbal divergent thinking (originality and fluency), a measure of creative potential. These associations were examined with early adolescent youth and within a specific extracurricular context called Odyssey of the Mind Creative Problem-Solving Program. While nested in teams of five to seven members, youth collaboratively developed a creative solution to an ill-defined problem provided by the program developers over a four- to six-month span.
Participants

The sample for this study was drawn from early adolescent youth (ages 10-14 years) participating in the Florida Odyssey of the Mind Creative Problem-Solving Competition during the 2018-2019 season. Recruitment focused on the Sun Region which is located in southwest Florida. This region was selected based on willingness of the Sun Region administration to facilitate the recruitment of participants. Included in the sample were upper elementary and middle school youth who regularly attended Odyssey of the Mind practices and who were documented members of an Odyssey of the Mind team registered to compete in the 2019 Sun Regional Tournament. Parental consent forms were disseminated two weeks prior to data collection, and forms were returned for a total of 101 youth, which represented 60.1% of the total eligible youth participating in Odyssey of the Mind program for Division II during that year. This response rate fell within an acceptable sample size range as projected by a power analysis conducted prior to data collection.

Sample Size, Power, and Precision. An a priori power analysis was conducted using G*Power3 (Faul et al., 2009) for sample size estimation. With power equal to .80 and an alpha equal to .05, the sample size needed to detect factor correlations with medium effect sizes ($d = .30$) was 84 participants. This sample size was determined based on the G*Power3 input for the bivariate correlation normal model option using a two-tailed test. To achieve a power of .90, 112 participants would have been needed. Therefore, the projected sample size needed for the current study to warrant an 80% to 90% chance of correctly rejecting the null hypotheses for each bivariate correlation examined was 84 to 112 participants. Thus, the achieved sample size ($N=101$) fell within the projected range to be more than adequate for the main objectives of this study.
Table 1

Frequency of Team Membership

<table>
<thead>
<tr>
<th>Team Number</th>
<th>n</th>
<th>Percent</th>
<th>Approximate Mean Age</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>1.98</td>
<td>9.0</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>6.93</td>
<td>9.6</td>
<td>0.54</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>5.94</td>
<td>10.3</td>
<td>0.52</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2.97</td>
<td>12.0</td>
<td>0.00</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>3.96</td>
<td>11.8</td>
<td>0.50</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>6.93</td>
<td>12.1</td>
<td>0.38</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>6.93</td>
<td>11.4</td>
<td>0.79</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>3.96</td>
<td>12.0</td>
<td>0.82</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>4.95</td>
<td>10.6</td>
<td>1.82</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>2.97</td>
<td>11.7</td>
<td>2.31</td>
</tr>
<tr>
<td>11</td>
<td>6</td>
<td>5.94</td>
<td>9.7</td>
<td>0.52</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>3.96</td>
<td>9.8</td>
<td>0.50</td>
</tr>
<tr>
<td>13</td>
<td>6</td>
<td>5.94</td>
<td>10.0</td>
<td>0.00</td>
</tr>
<tr>
<td>14</td>
<td>7</td>
<td>6.93</td>
<td>9.0</td>
<td>0.00</td>
</tr>
<tr>
<td>15</td>
<td>7</td>
<td>6.93</td>
<td>9.4</td>
<td>0.54</td>
</tr>
<tr>
<td>16</td>
<td>5</td>
<td>4.95</td>
<td>10.0</td>
<td>0.00</td>
</tr>
<tr>
<td>17</td>
<td>7</td>
<td>6.93</td>
<td>10.0</td>
<td>0.00</td>
</tr>
<tr>
<td>18</td>
<td>5</td>
<td>4.95</td>
<td>12.0</td>
<td>0.00</td>
</tr>
<tr>
<td>19</td>
<td>6</td>
<td>5.94</td>
<td>9.7</td>
<td>0.52</td>
</tr>
</tbody>
</table>

Note: Mean number of youths per team was 5.32. The mode for team membership was 7.

Participants included 65 elementary school students and 36 middle school students. The largest subgroup was 5th graders comprising 40.6% of the total sample. Participants were nested within 19 teams across 13 school districts representing five geographically diverse counties. The average team size was 5.32 and the mode for team membership was 7. Grade-level data were collected for each youth; however, age was not collected. To approximate the mean age for each team, a proxy value was assigned to each grade level and subsequent descriptive statistics were calculated. These values ranging from age 9 (4th grade) to age 13 (8th grade).

As shown in Table 2, the sample was slightly more female (62%) and was predominantly white (75%). The sample composition was not representative of the wider regional student
populations. For example, in Lee County, Florida, the population is comprised of 66.8% White; 21.9% Hispanic/Latino; 8.5% African American/Black; 1.6% Asian; 1.04% Multiracial (US Census, 2019).

Table 2

*Demographic Characteristics of Participants*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>38</td>
<td>37.6</td>
</tr>
<tr>
<td>Female</td>
<td>62</td>
<td>62.4</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>76</td>
<td>75.2</td>
</tr>
<tr>
<td>Asian</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Hispanic</td>
<td>10</td>
<td>9.9</td>
</tr>
<tr>
<td>African American</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>Multiracial</td>
<td>12</td>
<td>11.9</td>
</tr>
<tr>
<td>Grade Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th grade</td>
<td>24</td>
<td>23.8</td>
</tr>
<tr>
<td>5th grade</td>
<td>41</td>
<td>40.6</td>
</tr>
<tr>
<td>6th grade</td>
<td>8</td>
<td>7.9</td>
</tr>
<tr>
<td>7th grade</td>
<td>21</td>
<td>20.8</td>
</tr>
<tr>
<td>8th grade</td>
<td>7</td>
<td>6.9</td>
</tr>
</tbody>
</table>

**Procedure**

**Recruitment of youth participants.** With support from the Florida Odyssey of the Mind (FLOMA) leadership, all youth in grades 5-9 who were members of a team within the Sun Region in 2018-2019 were invited to take part in the study. A letter of support from FLOMA may be found in Appendix B. Invitations were forwarded by the administration to each registered coach. Coaches determined youth interest in participating in the study and communicated with parents about the opportunity to engage in the research. Once coaches accepted this invitation, the PI worked directly with each coach to obtain written parental consent for each participating youth as well as to schedule and administer the study measures.
An example of the consent form may be found in Appendix C. Consent forms explained the purpose of the study, the voluntary nature of the study, and the processes for maintaining confidentiality of the participant responses. Parental consent forms were collected by the researcher at the time of data collection.

On the day of data collection, youth who had been granted parental consent were asked to sign an assent form (Appendix D). Both consent forms included research procedures, purposes of the study, possible risks and benefits, and contact information for the PI. In those forms, it was made clear that participating youth had the opportunity to withdraw from the study at any time. Participant confidentiality was ensured through random assignment of an identification number to each participant for use in all data entry (i.e., 1-101). To further ensure participant understanding, the PI read the assent form aloud to youth prior to administering the questionnaires. Only participants who provided written assent on the day of data collection were permitted to complete the questionnaires. All youth complied with this expectation. The completed consent and assent forms were placed in a secure file cabinet for which only the PI had a key.

**Ethical Considerations.** The current study posed minimal risk to youth participants. Participants did not benefit directly from participating in the study, although youth may possibly have benefited by gaining a better understanding of the Odyssey of the Mind context as a need-supportive environment or of their personal motivations to engage in creative processes. No incentives were offered for participation in the study; however, all youth who appeared for the data collection event were invited to choose from a box of Odyssey of the Mind “problem pins” (i.e., decorative pins that can be affixed to clothing or backpacks and that represent various ill-
defined problems posed at previous competitions). These pins usually feature “Omer the Raccoon,” a symbol of creativity within the Odyssey of the Mind program.

At all stages of the study, precautions were taken to protect participants. The PI ensured that her Institutional Review Board (IRB) training certification was current and confirmed precautions were taken to protect human research participants over the course of the research process. Permission from the Florida Odyssey of the Mind and the University of South Florida were obtained prior to data collection. A certificate of IRB approval may be found in Appendix E.

**Data collection.** Data were collected on March 2, 2019 at the Sun Regional Creative Problem-Solving Competition. The competition took place in a large high school in southwest Florida. A dedicated classroom for the purpose of the study was assigned by the program leadership. At the time of data collection, coaches escorted participating team members to the classroom. The PI was the only adult permitted in the room during testing; other adults were asked to wait outside until youth had completed the study requirements. Each testing session lasted one hour. The number of students present during each session ranged from 10 to 21 (i.e., 2-3 teams per session). Two supplemental meetings for data collection were arranged at the request of the coaches who had difficulty finding the study location within the school and therefore missed the start time for their respective teams. These supplemental sessions took place within one week of the originally planned data collection.

**Measures**

Youth responded to 72 questions across three psychometric instruments administered in paper-and-pencil format. Questionnaires were distributed and collected in order of planned administration (i.e., assent forms, demographic form, a measure of basic psychological need
satisfaction and frustration, a measure of types of motivation, and six verbal divergent thinking tasks, respectively).

**Demographic Form.** The demographic form asked participants to self-report academic grade, gender, race, academic placement (gifted or no gifted services) and the number of years participating in the Odyssey of the Mind program. Demographic variables were collected for future analyses but were not central to the aims of the present study.

**Modified Basic Psychological Need Satisfaction and Frustration Scale.** The Basic Psychological Need Satisfaction and Frustration Scales (Chen et al., 2015) assessed early adolescent youth perceptions of how basic psychological needs for competence, autonomy, and relatedness were satisfied (or frustrated) within a specific environment.

**Pre-testing.** In developing the research design, the psychometric properties of five instruments assessing motivation, engagement, and beliefs about the nature of creativity were investigated with a sample (n=84) of early adolescents participating in the Odyssey of the Mind program in 2017. Findings indicated that most measures selected (e.g., creative self-efficacy, creative mindsets, and engagement) did not produce adequate evidence to demonstrate construct validity nor acceptable reliability. However, the Basic Psychological Need Satisfaction and Frustration Scales (BPNSFS; Chen et al., 2015) were found to have elicited adequate support for construct validity for use with early adolescent youth; thus, the measure was retained for use in the current study.

In the original study, Chen et al., (2015) reported factor loadings ranging from .61 to .80 for each item in the six subscales that comprised need satisfaction (autonomy, relatedness, and competence) and need frustration (autonomy, relatedness, and competence). The authors reported that the model fit the data well, with Satorra–Bentler scaled chi-squared statistic [SBS-
χ² (231) = 372.71], comparative fit index (CFI) = 0.97, root mean square error of approximation RMSEA = 0.03 and standardized root mean square residual (SRMR) = 0.04. The internal consistency for each scale was reported to be between .64 and .89.

In the pretest study for youth participating in Odyssey of the Mind in 2017, results indicated acceptable fit for need frustration when compared to guidelines established by Hu and Bentler (1999); fit indices were reported as SBS-χ² (51) = 62.72, p < .05, CFI = 0.96, RMSEA = 0.05 and SRMR = 0.07. The model for need satisfaction did not fit as well; however, some methodologists have argued that the model fit RMSEA index could be considered “mediocre” if found between .08 and .10 (MacCallum et al., 1996) and if CFI is found to be between .90 and .95 (Bentler, 1990). Based on these guidelines, the need satisfaction scale was deemed to have adequate fit with the pretesting sample with these fit indices: SBS-χ² (51) = 83.29, p < .01, CFI = 0.90, RMSEA = 0.09 and SRMR = 0.09.

Subsequently, the measure was modified to specify the Odyssey of the Mind context at the item-level and was scaled to better accommodate early adolescent youth comprehension of items. The original scale was modified from a five-point to a four-point measure (1 = not at all true to 4 = very true). This instrument included 24 items - four items per each of the following six subscales: competence satisfaction (e.g., “During Odyssey of the Mind, I feel confident that I can do things well”), competence frustration (e.g., “During Odyssey of the Mind, I feel disappointed about many of my performances”), autonomy satisfaction (e.g., “During Odyssey of the Mind, I feel a sense of choice and freedom in the things I undertake), autonomy frustration (e.g., “During Odyssey of the Mind, I feel forced to do many things I wouldn’t choose to do”), relatedness satisfaction (e.g., During Odyssey of the Mind, I feel that the people I care about also
care about me”), and relatedness frustration (e.g., “During Odyssey of the Mind, I have the impression that people I spend time with dislike me”).

**Modified Self-Regulation Questionnaire – Academic Scale.** The Self-Regulation Questionnaire – Academic Scale (Ryan & Connell, 1989) was modified to assess early adolescent youth perceptions of their motivations to engage in creative processes within the Odyssey of the Mind context. The modified scale used a four-point scale (1 = not true at all to 4 = very true) and included 32 items measuring four motivational regulation styles (i.e., from autonomous to controlled): intrinsic motivation, identified regulation, introjected regulation, and external regulation. Cronbach’s alpha values ranging from .79 to .94 have been reported for the four subscales (Mueller & Hancock, 2008). The modified version for the current study tailored items to fit the Odyssey of the Mind context and were sorted according to four specific questions as shown in Table 3.

Table 3

*Number of Items per Domain by Motivation Subscales*

<table>
<thead>
<tr>
<th>Measure Domain</th>
<th>Type of Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Why do I participate in Odyssey of the Mind program?</td>
<td>2 2 2 2</td>
</tr>
<tr>
<td>2. Why do I help develop creative solutions to the “long-term” problem?</td>
<td>2 2 2 2</td>
</tr>
<tr>
<td>3. Why do I try to come up with creative responses during the “spontaneous thinking” practice activities?</td>
<td>2 2 2 2</td>
</tr>
<tr>
<td>4. Why do I try to do well at Odyssey of the Mind competition?</td>
<td>1 1 3 3</td>
</tr>
</tbody>
</table>

*Note.* INT = Intrinsic motivation. ID = Identified regulation. INTR = Introjected regulation. EXTR = External regulation.

A full inventory of all items and descriptive statistics per item are located in Appendix J.
**Verbal Divergent Thinking.** Six divergent thinking tasks were chosen to examine fluency and originality in creative thinking of participating youth. The tasks were selected from what is known in the creativity research literature as “uses tasks” and stem from Guilford’s Alternate Uses Tasks (1967, 1978). The chosen tasks assessed the “verbal domain” of divergent thinking (creative ideation expressed semantically). These tasks were selected due to their close alignment to the “verbal spontaneous thinking” training youth receive in the Odyssey of the Mind program context and due to the likelihood that exposure to such training approximates more formal creativity training found in experimental studies. For example, recent research has indicated that verbal creativity training may improve creative potential. Fink et al. (2019) found a significant main effect among 4th graders who received verbal creativity training using adapted Alternate Uses (Guilford, 1967) tasks, \( F(1, 74) = 5.19, p = .03, \eta^2_p = 0.07. \)

The administration protocol developed by Nusbaum, Silvia, and Beaty (2015) for these tasks was followed (see Appendix I). Youth were asked to generate responses to each task: unusual uses (“brick” and “pencil”), unusual instances (“things that are round” and “things that make a noise”), and unusual consequences (“people no longer need sleep” and “people shrinking to 12 inches in height”). Tasks were administered in the following order: “brick,” “round,” “no sleep,” “pencil,” “noise,” and “shrinking.”

Youth were informed that the divergent thinking tasks were similar to the “spontaneous thinking” game-like activities of Odyssey of the Mind. Youth were instructed to “be creative” when responding and to try to come up with responses that “no one else might have thought up.” Youth were given three minutes to complete each task per established protocols (Silvia, 2008). After generating responses to each task, youth were asked to read their responses silently and to evaluate their own creative thinking. Next, youth were instructed to circle the “top three”
responses generated that they thought to be their most creative. By using this “top three” method, fluency as a confounding factor can be mitigated (Benedek et al., 2013, Nusbaum et al., 2015; Runco, 1986; Silvia, 2008).

**Recruitment of divergent thinking raters.** To ensure that each idea generated by youth was scored by three qualified raters, the PI recruited two other qualified adults with training in education to score responses generated from the six divergent thinking tasks. All three raters had experience teaching early adolescent youth in public school settings. The PI earned a Master of Science degree in Curriculum & Instruction with a concentration on Secondary English Education and subsequently taught middle and high school students for five years and was typically assigned to teach gifted students. Additionally, the PI was trained and served as an Odyssey of the Mind Spontaneous Thinking Judge in 2016. The second rater recruited was a doctoral candidate in the Educational Psychology program at the University of South Florida with experience teaching high school psychology courses. The third rater was an experienced elementary and middle school gifted teacher who had coached and judged Odyssey of the Mind “spontaneous thinking” responses. All scorers were trained using established protocols for the divergent thinking tasks (Beaty et al., 2015; Silvia, 2011).

**Fluency Scoring.** Fluency was computed as the total number of unique ideas generated by each participant for each of the six divergent thinking tasks. If an idea generated by a respondent was too conceptually similar to another idea generated by the same respondent, the duplicate concept was removed from the fluency count. Each rater calculated ideational fluency independently. Discrepancies in number of unique ideas counted were resolved if at least two of three raters were in agreement. No cases were found in which all three raters determined different fluency counts.
**Originality Scoring.** Responses were extracted from the paper-and-pencil hard copies and entered into a spreadsheet verbatim. The PI worked with each rater to ensure reliability in individual scoring. Examples of “original” versus “common” responses were discussed (e.g., the response of “ball” for an unusual instance of something round would be scored as very common; whereas, “an argument” would be rated as “original”). Raters were directed to score each response on a four-point scale (0 = *not creative* to 3 = *very creative*). In keeping with previous methods outlined by Benedek et al. (2013) to mitigate fluency as a confounding variable in the assessment of original ideas, raters assessed creativity (originality) only for the “top three” responses selected by the students as their most creative. For each task, scores for the “top three” were averaged and served as a final score for creativity (see Appendix I for the full protocol). Although using different stimuli, the “top three” scoring methods has reported task-specific intraclass coefficients ranging from .51 to .80 (Benedek et al., 2013).

**Analytic Strategy.** Prior to analyzing data, data were entered into a text document to be utilized for operations in both SPSS version 26 (IBM, 1989-2009) and Mplus8 version (Muthen & Muthen, 2012-2018) statistical software. Descriptive statistics identifying measures of central tendency (e.g., means, and standard deviations) and normality (e.g., skewness and kurtosis) were computed for each construct in the study: competence satisfaction, autonomy satisfaction, relatedness satisfaction, competence frustration, autonomy frustration, relatedness frustration, motivational styles (external regulation, introjected regulation, identified regulation, and intrinsic motivation), verbal divergent thinking (fluency and originality). Next, the quality of measures used was examined through confirmatory factor analyses, which yielded information about acceptability of internal structure of the adopted measures. All regression coefficients were standardized factor loadings to facilitate data interpretation. The fit indices examined were the
following: chi-square statistic and related $p$-value, the comparative fit index (CFA), the Tucker-Lewis index (TLI), the root mean squared error of approximation (RMSEA) and the standardized root mean squared residual (SRMR). Cronbach’s $alpha$ coefficients were calculated to examine internal consistency of each scale and subscale, with .70 being an acceptable cut-off (Devellis, 2012; Nunnally, 1978). After acceptable model fit and reliability was demonstrated, each research question was aligned to an appropriate statistical analysis (i.e., descriptive and correlational) as shown in Table 4.

Table 4

Research Questions Aligned to Analytic Strategy

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Analytic Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What are the perceptions of <strong>need satisfaction</strong> (autonomy, relatedness, and competence) and <strong>need frustration</strong> (autonomy, relatedness, and competence) among early adolescent youth participating in the Odyssey of the Mind context?</td>
<td>Descriptive statistical analyses and paired samples $t$-tests</td>
</tr>
<tr>
<td>2. How do <strong>perceptions of need satisfaction</strong> (autonomy, relatedness, and competence) and <strong>need frustration</strong> (autonomy, relatedness, and competence) relate to <strong>motivation</strong> (external, introjected, identified, and intrinsic) to engage in creative processes among early adolescent youth participating in the Odyssey of the Mind context?</td>
<td>Pearson product-moment correlations $(r)$</td>
</tr>
<tr>
<td>3. How do <strong>perceptions of need satisfaction</strong> (autonomy, relatedness, and competence) and <strong>need frustration</strong> (autonomy, relatedness, and competence) relate to <strong>verbal divergent thinking</strong> (fluency and originality) among early adolescent youth participating in the Odyssey of the Mind context?</td>
<td>Pearson product-moment correlations $(r)$</td>
</tr>
<tr>
<td>4. How does <strong>motivation</strong> (external, introjected, identified, and intrinsic) to engage in creative processes at Odyssey of the Mind relate to <strong>verbal divergent thinking</strong> (fluency and originality)?</td>
<td>Pearson product-moment correlations $(r)$</td>
</tr>
</tbody>
</table>

In addition to the preliminary descriptive statistics, research question one (RQ1) was answered through the use of paired samples $t$-tests, a strategy to examine the mean levels of perceived need
satisfaction (autonomy, relatedness, competence) difference from mean levels of perceived need frustration (autonomy, relatedness, competence) among participating adolescent youth.

To examine research questions three, four, and five (RQs 3-5), confirmatory factor analyses were performed to elicit Pearson product moment correlations among factors. The strength of associations between variables was assessed using guidelines established by Cohen (1988). A correlation coefficient of .10 was considered to represent a weak or small association; a correlation coefficient of .30 was considered a moderate correlation; and a correlation coefficient of .50 or larger was interpreted as representing a strong or large correlation. Data were examined for outliers that may have inflated or deflated the correlation coefficients or altered the directionality of the associations (Shavelson, 1988).
Chapter IV: Results

Results from statistical analyses conducted to examine four research questions are presented in this chapter. First, data screening methods are presented, followed by results of preliminary analyses. To address the main aims of the study, correlational analyses examining the associations among basic psychological need satisfaction and need frustration (autonomy, relatedness, competence), motivation regulatory styles (external, introjected, identified, and intrinsic), and verbal divergent thinking (fluency and originality) are reported.

Data Screening

Raw data used in the present study were obtained from paper-and-pencil versions of the measures chosen. Data related to need satisfaction, need frustration, and motivation variables were transferred case-by-case from the paper versions into a parallel, digital version created using Qualtrics software, Version XM (Qualtrics, Provo, UT). Data were checked for accuracy and exported from the software into a CSV (comma separated version) formatted spreadsheet. Responses to the divergent thinking tasks were entered verbatim in a separate spreadsheet. For each case, ideas that participants ranked as their “most creative top three ideas” were coded within the spreadsheet. Illegible responses were retained in the original data set.

Data integrity checks were completed by the principal investigator to ensure data were entered accurately (e.g., no errors in marking answers or inconsistent patterns existed in the response sets). In the event that questionnaires were marked unclearly (e.g., two answers marked, an answer was marked and then erased, etc.), the problematic responses were considered invalid.

Additionally, problematic or unclear responses were also checked by a graduate student
recruited to aide with the data preparation and scoring. The source data were preserved in a secure, online digital storage system using an online, cloud-based filing system; data are only accessible with a special password. Prior to performing the data analysis, data were entered into a text document to be used for the operations of SPSS version 26 (IBM, 1989-2009) and MPlus version 7.2 (Muthen & Muthen, 1998-2010) statistical software.

**Missing Data**

Both self-reported questionnaire data and divergent thinking responses were collected for this study. Data elicited from the basic psychological need satisfaction and need frustration scale and the modified motivation scale were virtually free of missingness (less than 2% per item). However, more missingness was found among the divergent thinking tasks data. No missing data were reported for the following tasks: “brick,” “no sleep,” and “pencil.” Less than 2% of the data was missing for “noise” and “shrinking.” There was greater missingness for the task “round” (18%).

To curtail missingness in the data set, questionnaires were checked by the PI at the time of data collection for any items that may have been skipped by respondents. Youth were asked to review their responses for completion as well. As long as more than 70% of participant responses were completed for a given scale, all available data were used to comprise a scale score for each individual. Due to the low missingness in the data elicited from the motivation variables (need satisfaction/frustration and regulation styles), this cutoff requirement was fully met for all participants.

Divergent thinking was scored by a group of trained scorers. Missingness among divergent thinking tasks may have been a result of the respondent’s inability to generate a meaningful response. This phenomenon would have been captured in the fluency scores reported.
for each individual. However, originality was computed as a mean of three scores assessed by the raters. If an individual only produced one viable idea, the individual’s singular originality score was represented by only that one item.

**Measure Reliability**

All self-report measures yielding scale or composite scores (i.e., BPNSFS and modified SRQ-A) were analyzed to determine their internal consistency. Cronbach’s alpha ranged from .64 (autonomy satisfaction) to .91 (intrinsic motivation). These values indicated acceptable estimates for reliability.

Table 5

*Psychometric Properties of Study Measures*

<table>
<thead>
<tr>
<th></th>
<th>Number of Items</th>
<th>Cronbach’s $\alpha$</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Need Satisfaction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autonomy Satisfaction</td>
<td>4</td>
<td>.64</td>
<td>13.01</td>
<td>2.43</td>
</tr>
<tr>
<td>Competence Satisfaction</td>
<td>4</td>
<td>.79</td>
<td>14.31</td>
<td>2.21</td>
</tr>
<tr>
<td>Relatedness Satisfaction</td>
<td>4</td>
<td>.83</td>
<td>13.83</td>
<td>2.48</td>
</tr>
<tr>
<td><strong>Need Frustration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autonomy Frustration</td>
<td>4</td>
<td>.76</td>
<td>7.77</td>
<td>2.80</td>
</tr>
<tr>
<td>Competence Frustration</td>
<td>4</td>
<td>.74</td>
<td>6.60</td>
<td>2.66</td>
</tr>
<tr>
<td>Relatedness Frustration</td>
<td>4</td>
<td>.81</td>
<td>6.07</td>
<td>2.75</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External Regulation</td>
<td>9</td>
<td>.81</td>
<td>14.04</td>
<td>4.62</td>
</tr>
<tr>
<td>Introjected Regulation</td>
<td>9</td>
<td>.78</td>
<td>20.09</td>
<td>5.24</td>
</tr>
<tr>
<td>Identified Regulation</td>
<td>7</td>
<td>.73</td>
<td>20.82</td>
<td>3.85</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>7</td>
<td>.91</td>
<td>25.74</td>
<td>3.67</td>
</tr>
<tr>
<td><strong>Verbal Divergent Thinking</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Originality</td>
<td>54</td>
<td>.69</td>
<td>1.21</td>
<td>0.26</td>
</tr>
<tr>
<td>Fluency</td>
<td>6</td>
<td>.82</td>
<td>6.81</td>
<td>2.38</td>
</tr>
</tbody>
</table>

*Note.* Range for need satisfaction, need frustration, and motivation summed scale scores was 4 to 16 with each item measured on a 4-point Likert scale. Range for originality scores was 0 to 3 (from least creative to most creative).
Analyses

The following statistical analyses were performed to answer each of the research questions posed in this study: (a) descriptive statistics (i.e., means, standard deviations, and normality) for each variable, and (b) measure reliability (i.e., Cronbach alpha coefficients for scale composite scores). First, data were analyzed to establish preliminary descriptions of how youth perceived the Odyssey of the Mind context according to basic psychological need satisfaction and frustration, motivation, and verbal divergent thinking. These preliminary analyses were followed by statistical analyses performed to address the main aim of this study: to describe the associations among the variables of interest.

Descriptive statistics identifying measures of central tendency in this sample (e.g., means, and standard deviations) and normality (e.g., skewness and kurtosis) were computed for each construct in the study and are presented in Tables 5 to 8 (see Appendices J and K for Tables 6 and 7). Most of the variables used in the study approximate a normal distribution (i.e., skew and kurtosis are between -2.0 and +2.0); however, some skewness and kurtosis were present. Data were examined for outliers that may have inflated or deflated the correlation coefficients or altered the directionality of the associations. Assumptions of linearity and homogeneity of variance were analyzed visually by examining the skewness and kurtosis values through use of a histogram. The visual analysis concluded that some violations to the assumption of normality had occurred.

The descriptive statistics reported in these tables will help to answer the first research question and are presented next. Additionally, each research question posed in Chapter I will be restated to aid the reader.
**Research Question 1:** What are the perceptions of need satisfaction (autonomy, relatedness, and competence) and need frustration (autonomy, relatedness, and competence) among early adolescent youth participating in the Odyssey of the Mind context?

The descriptive statistics reported in Tables 7 and 8 partially answer the first research question. In addition to these, to examine how need satisfaction was perceived in comparison to need frustration, a paired samples t-test was performed to test the hypotheses that basic psychological need satisfaction (autonomy, relatedness, and competence) and need frustration (autonomy, relatedness, and competence) means were equal. Prior to conducting the analysis, the assumption of normally distributed difference scores was examined. The assumption was considered satisfied as the skewness and kurtosis for each construct were less than the maximum allowable values (Kline, 2010). The null hypotheses of equal need satisfaction/need frustration means were rejected for each of the three pairs of needs, with each satisfaction need being significantly higher than the frustration need (see Table 6). Cohen’s $d$ was estimated using Cohen’s guidelines (1992) and all effects were found to be large.

<table>
<thead>
<tr>
<th></th>
<th>Need Satisfaction</th>
<th>Need Frustration</th>
<th>$t$ (100)</th>
<th>$d$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Autonomy</strong></td>
<td>$M$</td>
<td>13.01</td>
<td>2.43</td>
<td>7.77</td>
</tr>
<tr>
<td><strong>Relatedness</strong></td>
<td>$M$</td>
<td>13.83</td>
<td>2.48</td>
<td>6.07</td>
</tr>
<tr>
<td><strong>Competence</strong></td>
<td>$M$</td>
<td>14.31</td>
<td>2.21</td>
<td>6.60</td>
</tr>
</tbody>
</table>

*Note.* All $t$-tests were significant at $p < .001$. *Note.* Range for need satisfaction, need frustration summed scale scores was 4 to 16 with each item measured on a 4-point Likert scale. Cohen’s $d$ uses the sample standardized deviation of the mean difference.
Table 7

Means, Standard Deviations, Skewness, and Kurtosis of Observed Need Satisfaction Variables (N=101)

<table>
<thead>
<tr>
<th>Observed Variables</th>
<th>M</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Autonomy Satisfaction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. During Odyssey of the Mind, I feel that I have choice and freedom in the things</td>
<td>3.41</td>
<td>0.60</td>
<td>-0.75</td>
<td>1.11</td>
</tr>
<tr>
<td>2. I feel that my decisions on the Odyssey of the Mind project reflect what I really want.</td>
<td>2.85</td>
<td>0.95</td>
<td>-0.64</td>
<td>-0.38</td>
</tr>
<tr>
<td>3. For the Odyssey of the Mind project, I feel my choices express who I really am.</td>
<td>3.14</td>
<td>0.92</td>
<td>-1.00</td>
<td>0.66</td>
</tr>
<tr>
<td>4. When working on the Odyssey of the mind tasks, I feel I have been doing what really interests me.</td>
<td>3.46</td>
<td>0.72</td>
<td>-1.29</td>
<td>1.44</td>
</tr>
<tr>
<td><strong>Relatedness Satisfaction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I feel that the people I care about at Odyssey of the Mind also care about me.</td>
<td>3.46</td>
<td>0.70</td>
<td>-1.19</td>
<td>0.76</td>
</tr>
<tr>
<td>2. During Odyssey of the Mind, I feel connected with the coaches.</td>
<td>3.48</td>
<td>0.73</td>
<td>-1.35</td>
<td>1.41</td>
</tr>
<tr>
<td>3. During Odyssey of the Mind, I feel close with my Odyssey of the Mind team members.</td>
<td>3.50</td>
<td>0.66</td>
<td>-1.20</td>
<td>1.22</td>
</tr>
<tr>
<td>4. I experience a warm feeling with the people I spend time with during Odyssey of the Mind.</td>
<td>3.25</td>
<td>0.90</td>
<td>-1.11</td>
<td>0.45</td>
</tr>
<tr>
<td><strong>Competence Satisfaction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I feel confident that I can do things well during Odyssey of the Mind.</td>
<td>3.57</td>
<td>0.67</td>
<td>-1.51</td>
<td>1.80</td>
</tr>
<tr>
<td>2. During Odyssey of the Mind, I feel capable at what I do.</td>
<td>3.55</td>
<td>0.77</td>
<td>-1.74</td>
<td>2.38</td>
</tr>
<tr>
<td>3. During Odyssey of the Mind, I feel competent to achieve my goals.</td>
<td>3.59</td>
<td>0.60</td>
<td>-1.21</td>
<td>0.45</td>
</tr>
<tr>
<td>4. During Odyssey of the Mind, I feel I can successfully complete difficult tasks.</td>
<td>3.53</td>
<td>0.69</td>
<td>-1.53</td>
<td>2.40</td>
</tr>
</tbody>
</table>

*Note. Each item was measured on a 4-point Likert scale. *a*Indicates skewness and kurtosis outside the range of acceptable normality.*
### Table 8

*Means, Standard Deviations, Skewness, and Kurtosis of Observed Need Frustration Variables (N=101)*

<table>
<thead>
<tr>
<th>Observed Variables</th>
<th>M</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Autonomy Frustration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Most of the things I do at Odyssey of the Mind feel like things I am required to do.</td>
<td>2.41</td>
<td>0.99</td>
<td>1.72</td>
<td>-0.98</td>
</tr>
<tr>
<td>2. During Odyssey of the Mind, I feel forced to do many things I wouldn’t choose to do.</td>
<td>1.60</td>
<td>0.83</td>
<td>1.40</td>
<td>1.47</td>
</tr>
<tr>
<td>3. I feel pressured to do too many things during Odyssey of the Mind.</td>
<td>1.72</td>
<td>0.86</td>
<td>1.15</td>
<td>0.74</td>
</tr>
<tr>
<td>4. My Odyssey of the Mind activities feel like things I have to do.</td>
<td>1.97</td>
<td>0.97</td>
<td>0.61</td>
<td>-0.72</td>
</tr>
<tr>
<td><strong>Relatedness Frustration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I feel excluded from the Odyssey of the Mind team I want to belong to.</td>
<td>1.37</td>
<td>0.74</td>
<td>1.96</td>
<td>2.80*a</td>
</tr>
<tr>
<td>2. During Odyssey of the Mind, I feel that people who are important to me are cold and distant towards me.</td>
<td>1.34</td>
<td>0.68</td>
<td>2.16*a</td>
<td>4.29*a</td>
</tr>
<tr>
<td>3. I have the impression that the people I spend time with during Odyssey of the Mind dislike me.</td>
<td>1.49</td>
<td>0.82</td>
<td>1.76</td>
<td>2.42</td>
</tr>
<tr>
<td>4. During Odyssey of the Mind, I feel the relationships I have with coaches are just not close.</td>
<td>1.73</td>
<td>0.92</td>
<td>1.12</td>
<td>0.35</td>
</tr>
<tr>
<td><strong>Competence Frustration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I have serious doubts about whether I can do things well during Odyssey of the Mind.</td>
<td>1.67</td>
<td>0.84</td>
<td>1.20</td>
<td>0.90</td>
</tr>
<tr>
<td>2. I feel disappointed with my performance on projects during Odyssey of the Mind.</td>
<td>1.52</td>
<td>0.73</td>
<td>1.33</td>
<td>1.38</td>
</tr>
<tr>
<td>3. During Odyssey of the Mind, I feel insecure about my abilities.</td>
<td>1.67</td>
<td>0.90</td>
<td>1.21</td>
<td>0.57</td>
</tr>
<tr>
<td>4. I feel like a failure because of the mistakes I make during Odyssey of the Mind.</td>
<td>1.58</td>
<td>0.82</td>
<td>1.39</td>
<td>1.25</td>
</tr>
</tbody>
</table>

*Note.* Each item was measured on a 4-point Likert scale. "Indicates skewness and kurtosis outside the range of acceptable normality."
<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Autonomy Satisfaction</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Relatedness Satisfaction</td>
<td>.85***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Competence Satisfaction</td>
<td>.81**</td>
<td>.67***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Autonomy Frustration</td>
<td>-.68***</td>
<td>- .45**</td>
<td>-.65***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Relatedness Frustration</td>
<td>-.84***</td>
<td>-.91***</td>
<td>-.62***</td>
<td>.68***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Competence Frustration</td>
<td>-.81***</td>
<td>-.56***</td>
<td>-.92***</td>
<td>.69***</td>
<td>.81***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. External Regulation</td>
<td>-.57***</td>
<td>-.32**</td>
<td>-.53***</td>
<td>.71***</td>
<td>.36***</td>
<td>.44***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Introjected Regulation</td>
<td>-.26*</td>
<td>-.23*</td>
<td>-.38*</td>
<td>.49***</td>
<td>.22*</td>
<td>.45***</td>
<td>.81***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Identified Regulation</td>
<td>.66***</td>
<td>.58***</td>
<td>.56***</td>
<td>-.33**</td>
<td>-.55***</td>
<td>-.33***</td>
<td>-.21***</td>
<td>.05</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Intrinsic Motivation</td>
<td>.95***</td>
<td>.70***</td>
<td>.74***</td>
<td>-.64***</td>
<td>-.74***</td>
<td>-.61***</td>
<td>-.49***</td>
<td>-.16</td>
<td>.90***</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Verbal DT (Originality)</td>
<td>.41</td>
<td>.27*</td>
<td>.15</td>
<td>.13</td>
<td>-.10</td>
<td>.04</td>
<td>.18</td>
<td>.42***</td>
<td>.03*</td>
<td>.20</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>12. Verbal DT (Fluency)</td>
<td>.24</td>
<td>-.02</td>
<td>.08</td>
<td>-.03</td>
<td>.20</td>
<td>.02</td>
<td>.13</td>
<td>.14</td>
<td>-.01</td>
<td>-.08</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* *p* ≤ .05, **p* ≤ .01, ***p* ≤ .001; DT = divergent thinking.
**Research Question 2**: How do perceptions of need satisfaction (autonomy, relatedness, and competence) and need frustration (autonomy, relatedness, and competence) relate to motivation (external, introjected, identified, and intrinsic) to engage in creative processes among early adolescent youth participating in the Odyssey of the Mind context?

**Associations Among Need Satisfaction and Motivation.** Associations among need satisfaction latent variables and latent motivation regulatory styles variables ranged from .22 to .95 (absolute values). As expected, each of the need satisfaction constructs (autonomy satisfaction, relatedness satisfaction, and competence satisfaction) positively related to more autonomous types of motivation (identified and intrinsic). For example, intrinsic motivation was found to have a strong, positive correlation to autonomy satisfaction ($r = .95, p < .001$) as well as a moderately strong association to relatedness satisfaction ($r = .70, p < .001$) and to competence satisfaction ($r = .74, p < .001$). Identified regulation was found to have moderately strong, positive correlations to all three need satisfaction variables: autonomy satisfaction ($r = .66, p < .001$), relatedness satisfaction ($r = .58, p < .001$) and competence satisfaction ($r = .56, p < .001$). Conversely, need satisfaction variables related negatively to more externalizing, less autonomous types of motivation (i.e., introjected and external). External regulation was found to have a moderately strong, negative associations to autonomy satisfaction ($r = -.57, p < .001$), to relatedness satisfaction ($r = -.32, p < .01$) and to competence satisfaction ($r = -.53, p < .001$). Introjected regulation was found to have a negative, weak correlations to autonomy satisfaction ($r = -.26, p < .05$), to relatedness satisfaction ($r = -.23, p < .05$), and to competence satisfaction ($r = -.18, p < .05$).

**Associations Among Need Frustration and Motivation.** Associations among latent need frustration variables and latent motivation regulatory styles ranged from .22 to .74 (absolute values). As expected, need frustration for autonomy, relatedness, and competence negatively
related to more autonomous types of motivation (i.e., identified and intrinsic motivation) and positively related to more controlling, externalizing types of motivation (i.e., external and introjected). Intrinsic motivation was found to have moderately strong, negative correlations to autonomy frustration \((r = -.64, p < .001)\), to relatedness frustration \((r = -.74, p < .001)\) and competence frustration \((r = -.61, p < .001)\). Identified regulation was found to have moderately weak to moderate, negative correlations with all three need satisfaction variables: autonomy frustration \((r = -.33, p < .01)\), relatedness frustration \((r = -.55, p < .001)\), competence frustration \((r = -.33, p < .001)\).

Consistent with the previous pattern of relations, more controlling, less autonomous types of motivation (i.e., external regulation and introjected regulation) were found to be positively associated with all three basic psychological need frustration constructs. External regulation was found to have strong, positive associations to autonomy frustration \((r = .71, p < .001)\) and moderately strong associations with relatedness frustration \((r = .36, p < .001)\) and competence frustration \((r = .44, p < .001)\). Introjected regulation was found to have a positive, moderate correlation to autonomy frustration \((r = .49, p < .001)\) and to competence frustration \((r = .45, p < .001)\). There was weak, positive association found between introjected regulation and relatedness frustration \((r = .22, p < .05)\).

**Research Question 3:** How do perceptions of need satisfaction (autonomy, relatedness, and competence) and need frustration (autonomy, relatedness, and competence) relate to verbal divergent thinking (fluency and originality) among early adolescent youth participating in the Odyssey of the Mind context?

**Divergent Thinking.** As shown in Table 10, two factors related to divergent thinking were measured: fluency and originality. Youth generated the most number of unique ideas on average for the “name as many creative and unusual instances of something round” task \((M=\ldots\).
9.23, $SD = 4.76$) and the least number of unique ideas on average for the “consequences of shrinking to 12 inches tall” task ($M=5.07$, $SD=2.48$). The same tasks elicited the most and least originality from the sample, respectively ($M_{round} = 1.41$, $SD=0.53$; $M_{shrinking}=1.04$, $SD=0.39$).

Table 10
Means, Standard Deviations, Ranges, Skewness, and Kurtosis of Observed Verbal Divergent Thinking Variables

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fluency</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate Uses - Brick</td>
<td>101</td>
<td>6.92</td>
<td>3.43</td>
<td>15.0</td>
<td>0.92</td>
<td>0.62</td>
</tr>
<tr>
<td>Alternate Uses - Pencil</td>
<td>100</td>
<td>7.25</td>
<td>2.91</td>
<td>12.0</td>
<td>0.58</td>
<td>-0.22</td>
</tr>
<tr>
<td>Instances - Noise</td>
<td>98</td>
<td>7.07</td>
<td>3.44</td>
<td>18.0</td>
<td>0.99</td>
<td>1.08</td>
</tr>
<tr>
<td>Instances - Round</td>
<td>96</td>
<td>9.23</td>
<td>4.76</td>
<td>27.0</td>
<td>1.17</td>
<td>2.33</td>
</tr>
<tr>
<td>Consequences - No Sleep</td>
<td>101</td>
<td>5.34</td>
<td>2.37</td>
<td>14.0</td>
<td>1.17</td>
<td>2.34</td>
</tr>
<tr>
<td>Consequences - Shrinking</td>
<td>100</td>
<td>5.07</td>
<td>2.48</td>
<td>12.0</td>
<td>0.70</td>
<td>0.49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Originality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternate Uses - Brick</td>
<td>101</td>
<td>1.23</td>
<td>0.42</td>
<td>2.0</td>
<td>0.72</td>
<td>0.51</td>
</tr>
<tr>
<td>Alternate Uses - Pencil</td>
<td>100</td>
<td>1.14</td>
<td>0.39</td>
<td>1.8</td>
<td>0.31</td>
<td>-0.14</td>
</tr>
<tr>
<td>Instances - Noise</td>
<td>98</td>
<td>1.26</td>
<td>0.44</td>
<td>1.8</td>
<td>0.53</td>
<td>-0.38</td>
</tr>
<tr>
<td>Instances - Round</td>
<td>96</td>
<td>1.41</td>
<td>0.53</td>
<td>2.0</td>
<td>1.03</td>
<td>3.28</td>
</tr>
<tr>
<td>Consequences - No Sleep</td>
<td>101</td>
<td>1.16</td>
<td>0.34</td>
<td>2.0</td>
<td>0.97</td>
<td>1.78</td>
</tr>
<tr>
<td>Consequences - Shrinking</td>
<td>100</td>
<td>1.04</td>
<td>0.39</td>
<td>1.9</td>
<td>0.53</td>
<td>-0.24</td>
</tr>
</tbody>
</table>

*Note.* There is no set scale for fluency; it is a measure of how many unique ideas were generated by youth per task. Originality was scored on 0 to 3 scale (least creative to most creative).

**Associations Among Need Satisfaction and Verbal Divergent Thinking.** The connection between need satisfaction and verbal divergent thinking has not yet been examined. In the present study, only one association was found to be significant among need satisfaction variables and verbal divergent thinking. There was a moderately weak, positive correlation between relatedness satisfaction and originality ($r = .27, p < .05$).
Associations Among Need Frustration and Verbal Divergent Thinking. The connection between need frustration and verbal divergent thinking has not yet been examined in prior studies. In the present study, none of the correlations examined among need frustration (for autonomy, relatedness, and competence) and verbal divergent thinking (fluency and originality) were found to be significant.

Research Question 4: How does motivation (external, introjected, identified, and intrinsic) to engage in creative processes at Odyssey of the Mind relate to verbal divergent thinking (fluency and originality)?

Associations Among Motivation and Verbal Divergent Thinking. Among the associations between motivation variables (external, introjected, identified, and intrinsic) and verbal divergent thinking (fluency and originality), only two correlations were found to have statistical significance. There was a very weak correlation of identified regulation (a type of motivation in which the individual values the behavior they are engaged in, demonstrating volition) to verbal divergent thinking (originality) ($r = .03, p < .05$). The relation of introjected regulation (an externalizing form of motivation in which feelings of worth are conditional on one’s performance) to verbal divergent thinking (originality) was moderately strong and positive ($r = .42, p < .001$). It is notable that none of the fluency correlations were found to be statistically significant.
Chapter V: Discussion

In recent decades, the development of creative thinking and creative behaviors among children and youth has become an important focus of research and educational reform initiatives (Florida, 2002). The main goal of the present study was to examine a potentially rich developmental context for growing creativity in adolescence and to investigate how youth perceived their participation in a creative problem-solving program. Did youth perceive the context as supportive of their basic psychological needs for autonomy, relatedness, and competence? What motivations did these adolescent youth report as the driving forces behind their engagement in creative processes? What connection did these motivational drivers have to actual creative production? In this chapter, key findings will be discussed first, followed by how this study has contributed scholarly significance in the field, both theoretical and practical implications for the study, the strengths and limitations of the study, and finally directions for future research.

Key Finding 1 - Need Satisfaction over Need Frustration

A central tenet of Basic Psychological Needs Theory, a subset of Self-Determination Theory, is that the existence of three basic psychological needs (autonomy, relatedness, and competence) must be satisfied for humans to be fully integrated. Furthermore, the satisfaction of needs is contextually dependent (Deci & Ryan, 2000; Ryan & Deci, 2017). In the present study, a quantitative analysis was conducted to examine early adolescent youth perceptions of the Odyssey of the Mind context as supporting basic psychological needs.
Descriptive statistics and paired sample t-tests revealed that youth reported significantly higher levels of need satisfaction (autonomy, relatedness, and competence) than of need frustration. This finding is consistent with the first hypothesis that adolescents will report higher degrees of need satisfaction than degrees of need frustration within the Odyssey of the Mind context. High degrees of need satisfaction (defined as $M=3.5$ or more on a 4-point scale) were expected because the Odyssey of the Mind context is designed explicitly to allow youth working in small teams an opportunity to direct their own behaviors (need for autonomy) in the shared goal (need for relatedness) of producing a creative solution to an ill-defined problem (need for competence). Although youth reported all three needs as being satisfied in this context, the degree of satisfaction reported varied according to each subscale. Results indicated that all four items measuring competence satisfaction were endorsed the most highly by youth, followed by all four items measuring relatedness satisfaction next and then all four items measuring autonomy satisfaction, respectively. To explain this pattern, the framework of “need supportive teaching” can be used (Stroet et al., 2013).

In a comprehensive review summarizing 71 studies of teacher practices that support early adolescents’ motivation and engagement for school, Stroet et al. (2013) defined the term need supportive teaching as teachers’ provision of autonomy support, structure (i.e., factors supporting the need for competence), and involvement (i.e., factors supporting the need for relatedness). In the present study, coaches, peers, and parents may be considered comparable to the teachers examined in the need supportive teaching literature as contextual influences.

A comparison of means among the need satisfaction subscales demonstrated an interesting pattern: youth reported the need for competence as being more highly satisfied than the need for autonomy since youth are afforded freedom in the development of their Odyssey of
the Mind long-term solutions. Within Self-Determination Theory, to feel autonomous is similar to the feeling of having agency in one’s choices and decisions in a way that aligns to values and beliefs that are in accordance with one’s sense of self (Jang et al., 2012; Reeve, 2013, Stroet et al., 2013). Adults and peers help to create autonomy supportive environments by providing opportunities for youth to exercise agency and decision-making (Cheon et al., 2019; Reeve, 2020). Since the provision of autonomy support is considered a key attribute of the Odyssey of the Mind program design and is specifically highlighted in the coaches’ training and program resources, it is curious that youth endorsed autonomy satisfaction at lower levels than competence satisfaction and relatedness satisfaction.

It may be that some youth experienced the context as more satisfying of the need for competence because time and attention during practices are typically more focused on developing the team’s creative product than the team expects to be assessed by a panel of judges, which could heighten the team’s focus on competence. And, since this product is developed during team meetings when individual ideas are shared and considered for incorporation into the final creative product, it is possible that the need for autonomy was not at the forefront. Even when individual team members were assigned specific roles and tasks within the group project, it is possible that the need for autonomy was perceived as not only less important but necessarily subverted for the greater good of the project.

For example, results indicated that youth endorsed the first item in the autonomy frustration subscale (i.e., “Most of the things I do at Odyssey of the Mind feel like things I am required to do”) at moderately high levels ($M=2.41, SD=0.99$), indicating that more youth endorsed “true” and “very true” responses to this statement than did not. The other three items comprising the autonomy frustration subscale elicited results that fell between “not at all true”
and “not very true,” indicating the possibility that youth did not feel forced (see item AF2) or pressured (see item AF3) to participate; rather, the level of autonomy frustration experienced in the Odyssey of the Mind context may have been perceived as necessary to achieve team goals since the creative solutions generated would be assessed as part of a competition.

Not only do autonomy-supportive contexts afford youth agency in choosing tasks they perceive as interesting or important, autonomy-supportive contexts also encourage youth perceptions of relevance; whereas, autonomy-suppressive contexts contain elements that youth may perceive as pointless and dull (Assor & Kaplan, 2001; Belmont et al., 1992; Reeve et al., 2004; Stroet et al., 2013). Relevance is fostered in school settings when teachers discuss the value of the learning activities required of the students (Reeve et al., 2004). In the present study, since youth decided what was relevant to their long-term projects, it is possible that perceived relevance was an inherent aspect of the Odyssey of the Mind context. In other words, youth did not need to be convinced of the value of the Odyssey of the Mind activities; instead, project “tasks” were generated by the team members themselves and were not sourced from an authority figure such as a coach, teacher, or parent.

Other ways that a context may be considered autonomy-supportive are when youth are shown respect (Assor & Kaplan, 2001; Belmont et al., 1992), allowed to offer criticism and feedback on what they are experiencing (Assor & Kaplan, 2001), and when the adults and peers in the context use language that youth perceive as informational rather than as controlling (e.g., pressuring) (Reeve et al., 2004). On the other hand, youth may perceive a context as autonomy-suppressive when youth feel disrespected or when youth are not able to share critical or disapproving feedback (Assor & Kaplan, 2001). Children and youth learn from an early age that expressing disapproval in a classroom would likely be seen as disruptive. Thus, when youth are
bored or unenthusiastic, an autonomy-supportive response from a teacher might include
acknowledging and validating the youth’s expression of negativity and seeking suggestions from
the youth on how to improve the context to be more engaging (Reeve et al., 2020). Reeve et al.
(2020) articulated other autonomy-supportive instructional behaviors such as taking students’
perspectives, involving students in choosing learning activities, providing explanatory rationales
for the assignments, using invitational language for the activities, and displaying patience.
Since the Odyssey of the Mind coaches are a mixture of both teachers and volunteers with
varying degrees of experience working with youth, it is possible that provisions of these kinds of
autonomy support (or lack thereof) are not uniformly present in each team’s micro-environment.

While it may be surprising that youth reported autonomy satisfaction ($M=3.22$, $SD=0.80$)
at slightly lower levels than relatedness satisfaction ($M=3.42$, $SD=0.80$) and competence
satisfaction ($M=3.56$, $SD=0.68$), this pattern of results may be explained by an important aspect
of the Odyssey of the Mind program - the competition. High-scoring teams advanced to the state-
level competition and some also advanced to an international competition held in the United
States. It is likely that the presence of competition was a salient contextual factor related to
competence satisfaction and relatedness satisfaction.

**Key Finding 2 - Low-Stakes Competition as a Need Supportive Contextual Factor**

**Competition and Competence Satisfaction.** The Intrinsic Motivation Principle of Creativity
purports that creativity is supported when youth develop domain-specific and creativity-relevant
skills as well as task motivation (Amabile, 1996). Few studies have been conducted that examine
how the presence of competition affects creative performance (Plucker, personal communication,
2017). Research on creativity and competition reveals a complex interaction between
competition, cooperation, and creativity with mixed results (Worrell, 2016). It is possible that the
act of competing provided youth with the opportunity to affirm their attainment of these relevant skill sets. Since youth took part in the present study on competition day, the researcher was able to ask participants, “How’s it going?” and “When do you perform next?” It is possible that the competition heightened youth perceptions for the need for competence satisfaction, and therefore, youth may have reported their needs had been partially or fully satiated by the time youth were responding to questionnaires on the day of competition.

According to Cognitive Evaluation Theory, one of the six mini-theories of Self-Determination Theory that guided this research, competition is a contextual element that can add anticipation and dynamism to activities and can therefore stimulate certain types of motivation (Ryan & Deci, 2017). In some cases, competition can be experienced as pressure-for-performance or “need-thwarting” and controlling. However, the effects of competition are postulated to only be negative when the pressure outweighs aspects of the competition that make it fun, such as the “optimal challenge” described by Csikszentmihalyi (1990). “Optimal challenge” is a phrase commonly used in several theories of motivation referring to the relationship between the degree of challenge in the context and the amount of skill or ability currently within the individual involved in the activity; the balance between these helps to create a drive for personal improvement and intrinsic motivation (Csikszentmihalyi, 1990; Deci & Ryan, 2000).

Many Odyssey of the Mind team members are placed in academically gifted classrooms, and their participation in the competition is often an extension of in-class activities that gifted teachers use as enrichment to the gifted classroom. In some rare cases, Odyssey of the Mind is an elective class created solely for students with gifted designations. Subsequently, Odyssey of the Mind may be seen as a context that provides “optimal challenge” for gifted youth in particular.
On competition day, individual youth are able to see themselves as placed amidst a large number of other academically talented youth. The competition provides valuable informational feedback about their personal and team performances through the mechanism of social comparison (Ryan & Moller, 2017). As a result, the element of competition may be a key reason the need for competence is perceived as satisfied in the Odyssey of the Mind context.

In the present study, it is possible that youth developed perceptions of themselves as personally competent and self-efficacious creative problem-solvers as a result of the information gleaned from the performance evaluation at the Odyssey of the Mind competition; such feedback may have provided an external validation of their competence since social comparisons with others in their particular contexts are a common means for individuals to establish a standard of excellence against (Marsh et al., 2008; Marsh et al., 2017). For youth to feel competent, it is not only necessary to have effective functioning but to experience a continual stretching of one’s abilities; thus, the need for competence is fueled by the energy for learning. Ryan and Moller (2017) describe a mechanism for how individuals draw information from experiences like competitions to gauge their own competence with the phrase “standards and yardsticks” (2017, p. 221). It is likely that the youth at the Odyssey of the Mind competition may have used social comparison to mark the standard of creative performance and then measured themselves against these standards.

Regardless of the potential impacts of the competition day, it is likely that perceptions of competence satisfaction also developed during team practices throughout the year, depending on the degree of support provided by coaches and peers. Using the language from the need-supportive teaching framework (Stroet et al., 2013), this kind of support is referred to as the provision of structure. Structure includes four components in the environment that promote
youth feelings of competence: task clarity, task guidance and monitoring, encouragement, and constructive-informational feedback. It is possible that the Odyssey of the Mind coaches provided competence need support through the full or partial provision of structure.

**Competition and Relatedness Satisfaction.** While the competitive climate of the Odyssey of the Mind program may have influenced person-level perceived need satisfaction (or frustration) through social comparison, it may have also contributed to youth feelings of belongingness. The need for relatedness can be satisfied within interpersonal relationships or through feelings of belongingness within social groups (Stroet et al., 2013). It is possible that youth gradually built a sense of belonging as members of the Odyssey of the Mind team, especially if coaches and peers demonstrated the need-supportive practice of involvement, which may have included influence, physical proximity, attunement to what is happening in the lives of the kids, dedication of resources, and dependability (Stroet et al., 2013). In the present study, youth reported high degrees of relatedness satisfaction as indicated by the most highly endorsed item in the subscale (i.e., “I feel close with my Odyssey of the Mind team members”). This bond happened over time; teams typically met at least once but often twice per week over the course of six months to develop their creative solutions. The Odyssey of the Mind program expects youth to work independently on the creative production while also expecting the coaches to provide the socioemotional support and development of teamwork and cooperation.

It is not surprising that youth reported both high degrees of competence satisfaction and relatedness satisfaction in this low-stakes competition where the members work together towards a shared goal.
Key Finding 3 - Empirical Support for Self-Determination Theory within a Creative Context

A key purpose of the present study was to describe how the types of motivation that youth perceived as guiding their engagement in creative processes and behaviors within the Odyssey of the Mind context related to satisfaction (and frustration) of basic psychological needs for autonomy, relatedness, and competence, given that more autonomous forms of motivation (i.e., identified and intrinsic) are positively related to the satisfaction basic psychological needs for autonomy, relatedness, and competence according to the Organismic Integration Theory, a mini-theory of Self-Determination Theory (Deci & Ryan, 2000; Ryan & Deci, 2017).

It was expected that perception of need satisfaction would be strongly related to internalized (autonomous) forms of motivation; whereas, need frustration would be related to more externalized (controlled) forms of motivation (Deci & Ryan, 2000; Ryan & Deci, 2017). Prior research within the field of sport and exercise science has tested these associations and found comparable patterns. For example, Schneider and Kwan (2013) reported a strong, positive correlation between intrinsic motivation and competence satisfaction ($r = .66, p < .003$); a moderately strong, positive correlation between intrinsic motivation and relatedness satisfaction ($r = .42, p < .003$) and a weak, positive correlation between intrinsic motivation and autonomy satisfaction ($r = .29, p < .003$). The authors also examined the correlations between identified regulation and need satisfaction. Identified regulation positively correlated to competence satisfaction ($r = .51, p < .003$) and to relatedness satisfaction ($r = .25, p < .003$). However, the correlation of identified regulation to autonomy satisfaction ($r = .19$) was not statistically significant.
As shown in Table 11, the results from the present study fully supported this hypothesis and the findings from Schneider and Kwan’s (2013) prior research. In the present study, all correlations found among basic psychological need satisfaction and frustration variables were significantly related to the types of motivation youth reported experiencing in the Odyssey of the Mind context. Each quadrant of the table has been color-coded to highlight the pattern, and the strongest correlation among variables within each quadrant has been emboldened.

Table 11

**Correlations Among Need Satisfaction, Need Frustration, and Motivation (n=101)**

<table>
<thead>
<tr>
<th></th>
<th>Need Satisfaction</th>
<th>need Frustration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Autonomy</td>
<td>Relatedness</td>
</tr>
<tr>
<td>External</td>
<td>-.57***</td>
<td>-.32**</td>
</tr>
<tr>
<td>Regulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introjected</td>
<td>-.26*</td>
<td>-.23*</td>
</tr>
<tr>
<td>Regulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identified</td>
<td>.66***</td>
<td>.58***</td>
</tr>
<tr>
<td>Regulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsic</td>
<td>.95***</td>
<td>.70***</td>
</tr>
<tr>
<td>Motivation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Confirmatory factor analyses were conducted to elicit correlations among latent factors.*

Satisfaction for the needs of autonomy, relatedness, and competence was negatively associated with more controlling forms of motivation (e.g., external and introjected) and positively associated with more autonomous forms of motivation (e.g., identified and intrinsic); whereas, frustration for all three needs showed an opposite pattern of associations.

It is noteworthy that three out of the four quadrants implicated the need for autonomy as having primacy. The need for autonomy satisfaction was very strongly related to intrinsic motivation ($r = .95$, $p < .001$), and items measuring intrinsic motivation were endorsed by youth at high rates, ranging from 3.64 to 3.71 on a four-point scale. This strong relationship may
indicate some conceptually overlapping latency that should be examined in subsequent studies. When asked about why they participated in the program, in the creative problem-solving processes, in the spontaneous thinking activities, and in the culminating competition, youth consistently indicated that Odyssey of the Mind was “fun” and “enjoyable.” Since enjoyment is a proxy for intrinsic motivation and since autonomy satisfaction is predicated upon contextual supports that were reported as present by Odyssey of the Mind participants, this strong association validates extant research, much of which is derived from the field of exercise science and physical education (Ryan & Deci, 2017; Schneider & Kwan, 2013; Walker, Yan & Kono, 2020). For example, Schneider and Kwan (2013) found that intrinsic motivation for exercise among adolescents may be enriched when the context supports perceived competence, relatedness, and autonomy, and when adolescents join in activities that they find fun. Walker, Yan, and Kono (2020) found that autonomy and relatedness satisfaction also positively correlated with intrinsic motivation during leisure activities.

External regulation (controlled motivation) is also strongly related to the need for autonomy in the present study. It was negatively related to autonomy satisfaction ($r = -.57, p < .001$) and positively related to autonomy frustration ($r = .71, p < .001$). This pattern is also consistent with the Self-Determination Theory literature. External regulation is a common form of motivation and typically has negative effects on autonomy satisfaction. Some of the regulatory processes that underlie externalized forms of motivation include “compliance,” “external rewards,” and “punishments” (Ryan & Deci, 2017).

As previously noted, youth may have perceived the constraints of the Odyssey of the Mind competition (e.g., rules for product development and expectation for team cooperation in the creative solution) as necessary for compliance in the program. Odyssey of the Mind coaches
were tasked with providing oversight in the practices to help the team meet the competition requirements, and this structure may have contributed to a context that youth experienced or perceived as somewhat controlling. Yet even with some degree of perceived autonomy frustration, the consistency with which the youth responded to the indicators on the external motivation scale ($\alpha = .81$) demonstrated that youth did not generally view Odyssey of the Mind as a controlling context.

**Key Finding 4 - Lacking Evidence of a Relationship Between Intrinsic Motivation and Divergent Thinking**

Creativity flows when people enjoy engagement in the task (Csikszentmihalyi, 1990). This study sought to integrate elements of Self-Determination Theory (Deci & Ryan, 2000) and the Intrinsic Motivation Principle of Creativity (Amabile, 1983; 1996). Taken together, intrinsic motivation should be optimized when basic needs are satisfied. For that reason, it was expected that need satisfaction (autonomy, relatedness, and competence) would be positively related to an individual youth’s ideational fluency and ideational originality in the verbal domain (ideas conveyed through words as opposed to pictures). Prior research has shown strong associations of intrinsic motivation and divergent thinking as well as with other expressions of creative production (ranging from $r = .30$ to $r = .36, p < .001$) (de Jesus et al., 2013; Ceci and Kuman, 2016).

Despite these positive associations and evidence of a lively debate about the undermining effects of rewards on intrinsic motivation and creative performance (see Amabile & Hennessey, 1995), results in the present study found no discernable relationship between intrinsic motivation and verbal divergent thinking! However, a weak, positive correlation between relatedness satisfaction and verbal originality was found ($r = .27, p < .01$) as well as a moderate, positive
relation to introjected regulation (e.g., engaging in behaviors to avoid feeling guilty) as well as a weak, positive relation to identified regulation (e.g. valuing the task despite not having it come from oneself). These last two findings provide evidence for why the study of motivational processes in relation to creativity are hindered by simplistic measurement approaches (e.g., adopting the extrinsic-intrinsic motivation model). This finding also indicates the need for examining creativity in more expansive ways than only through verbal divergent thinking tasks (a typical approach).

**Contributions to the Literature/Scholarly Significance**

The present study lays groundwork for the application of the recently updated iterations of Self-Determination Theory (Deci & Ryan, 2000; Ryan & Deci, 2017) to the study of creativity development during adolescence. Additionally, this work builds upon the few existing studies in that have operationalized motivation on a continuum from more controlled to more autonomous motivations. Finally, this work adds to the growing body of literature concerned with documenting the unique benefits of informal, out-of-school environments where so many youths are finding joy and fulfillment.

**Theoretical Implications**

In addition to validating the conceptual integrity and interrelatedness of three mini-theories (Basic Psychological Needs Theory, Cognitive Evaluation Theory, and Organismic Integration Theory) within Self-Determination Theory (Deci & Ryan, 2000; Ryan & Deci, 2017), the results presented here lay a foundation for the application of the need-supportive teaching framework (Stroet et al., 2013) to the study of contextual factors influencing creativity development, specifically creative thinking and behaviors typical of early adolescent youth. Recently, Edward Deci and Richard Ryan (2020) as well as Maarten Vansteenkiste, Richard
Ryan, and Bart Soenens (2020) appealed for more research into need-supportive and need-thwarting practices.

**Practical Implications**

This study also has practical implications. Findings could influence the development and administration of extracurricular programs with a special focus on intentionally preparing coaches to support “creative needs.” By transferring the key ideas from the “need-supportive teaching” paradigm to the examination of contexts conducive to (or inhibitory of) creative thinking, findings from the present study may provide useful feedback to parents, coaches, and youth about the benefits of participating in Odyssey of the Mind or similar programs. In sum, this work may inform future research on need-supportive environments and their role in the development of adolescent creativity.

Fostering creative thinking and behaviors during adolescence have implications for adolescent adjustment (Barbot & Heuser, 2017), academic achievement (Gadja et al., 2017), and well-being (Besançon et al., 2015). How creativity is to be cultivated during adolescence requires a thoughtful understanding of how contextual factors could potentially foster types of motivation that drive youth to engage in creative processes and to persist through the challenging moments towards creative production. Sometimes these tasks are not always intrinsically motivated as has been widely promulgated in the literature. Nor is it likely that such task motivation is ever fully externalized. There is simply more nuance and variation in the motives that drive creativity during adolescence.

In the past decade, creativity researchers have begun to acknowledge the lack of research focused on contextual factors that contribute to what motivates youth to pursue creative endeavors. Some researchers have approached this gap by examining the beliefs youth and adults...
have about creativity and about self-efficacy for producing creative products. For example, Karwowski and Beghetto (2019) recently put forth a model of Creative Behavior as Agentic Action (CBAA) to explain the mediating role of creative confidence and the moderating role of perceived value of creativity on “any behavioral indicator that is predictive of creative behavior” (p. 403). The present study builds on this approach by highlighting potential motivators for contextual conditions (e.g., quality of coaching, team member rapport, opportunity to practice creative processes, presence of rewards-for-creative performance, etc.) conducive to creativity among youth.

Contexts like Odyssey of the Mind are programmatically built to allow youth to showcase and celebrate divergent thinking applied in a real-world setting. These are particularly powerful developmental opportunities when contrasted against the implicit value placed upon convergent thinking as the preferred mode for academic competence within school settings. Thus, such environments hold the potential to satisfy basic psychological needs for autonomy, relatedness and competence.

Results from this study also have implications for creativity measurement practices. Per recommendations outlined by Silvia et al. (2008) and Benedek et al. (2013) for college-aged populations, three minutes were given to complete each task, a time frame that has been previously shown to produce an adequate number of candidate ideas from which youth would evaluate and select their “top three” most creative ideas. This approach intended to allow for generating enough item-level indicators of creative potential to promote sufficient reliability and validity while reducing rating effort.
Strengths and Limitations

**Strengths.** Odyssey of the Mind has been continuously in operation since 1978 and has expanded to 25 countries (Creative Competitions, Inc., 2018). Over the past four decades, seven dissertation studies have focused on the program, of which only two identified creative thinking as a research target (see Fishkin, 1989; Shook, 1997). Given the broad reach of the program, the choice to examine Odyssey of the Mind as a developmental context is a strength of the study due to the increased interest in research on out-of-school contexts as alternatives to traditional k-12 schools for providing opportunities to develop learning experiences that promote higher-order thinking skills among youth.

The focus on adolescent youth is a strength of this study. Research that examines the intersection of creativity and motivation and which focuses solely on adolescent youth is scant; however, in recent years, the Beghetto’s (2006) work on creative self-efficacy among middle school students in school settings, Barbot, Lubart, and Besancson’s (2016) work on individual trajectories of creativity development during adolescence, and Kleibeuker, DeDreu, and Crone’s (2016) work using brain imaging to test effects of creativity training during adolescence collectively point to how the field is prioritizing the inclusion of developmental approaches that focus on adolescence. This study is situated within that trend.

Another strength of the present study was the focus on applying three of the widely influential mini theories within Self-Determination Theory to the field of creativity research. This application broadens how motivation for creativity is conceptualized beyond the initial work of Amabile (1990, 1996) whose earlier work in the development of the Intrinsic Motivation Principle of Creativity promoted the extrinsic-intrinsic paradigm. Furthermore, it was a strength of this study to adopt the need-supportive teaching framework (Stroet et al., 2013) as a lens for
interpreting results because it holds promise for practical applications for designing environments that intentionally promote need satisfaction.

A methodological strength of this study was the adoption of new strategies to improve the use of divergent thinking tasks in creativity research. The creativity tasks used to measure verbal divergent thinking followed the same protocols established by Silvia et al. (2008) and Benedek et al. (2013). These included the adoption of game-like conditions for the idea generation and the inclusion of youth-evaluations of their own creative ideas which resulted in a “top three” scoring system designed to minimize the confounding influence of ideational fluency on ideational originality (Benedek et al., 2013). As such, results from this study provided replication of new methods shown to improve reliability in creativity measurement.

**Limitations.** Notwithstanding the theoretical and practical contributions as well as the particular strengths of the current study, several limitations must be considered. These include the use of self-reported data, convenience sampling, and additional issues of population validity. First, self-reported data were needed for measuring adolescent perceptions of the Odyssey of the Mind context. There are several drawbacks in using self-reported data. Self-reporting requires respondents to endorse a single statement with a ranking of agreement on a scale (e.g., Likert scales). With this type of assessment, there is a risk that respondents will be guided by social desirability (tendency to respond according to a perception of what is preferred by others) or acquiescence (tendency to select responses on the positive side of the rating scale, regardless of the content of the item (Kreitchmann et al., 2019). By extension, disaquiescence would describe a pattern of responses that indicated a tendency to select options on the negative side of the rating scale. In both cases, these behaviors are undiscerning and indiscriminate. Additionally, there are limitations in the use of Likert formatted items. In some cases, their use could distort
the interpretation of results, leading to false claims of generalizability or in disregarding variables that may serve as mediators and/or moderators and thus could muddle the results (Fulmer & Fritjer, 2009).

This tendency toward social desirability could be even more noticeable for adolescent youth who are keenly influenced by their peers’ attitudes and for whom social belonging is a strong motivator. To mitigate susceptibility of such response bias, youth were told to give intention thought to their response choices in order to increase the quality of the research study. If youth were observed to be engaged in sidebar conversations or to be looking at each other’s surveys, the researcher used quiet physical proximity to gently remind the respondents to respond uniquely and without worrying about what a neighboring youth wrote down.

To offset the potential pitfalls of self-report measures, future research could include multiple data sources, such as focus groups, interviews, observations, coach and parent appraisals, etc.

Another limitation was the small sample of participants. Although 60% of the possible respondents participated in the study, the sample size was 101. Because the data were collected on the day of the Odyssey of the Mind competition, recruiting efforts were not as successful. It is possible that those youth on teams that did not participate may have responded differently on the questionnaire items than did the participants. To address concerns about population validity and generalizability of results, efforts should be made to confirm the representativeness of the participating population.

Another limitation concerns the narrow focus on divergent thinking to exclusion of other measures of creativity (e.g., creative products assessed through the Consensual Assessment Technique or creative behaviors). Within the field of creativity research, there is an active debate about the role of divergent thinking in creativity measurement. may be one of the
reasons that the main tenet from Intrinsic Motivation Principle of Creativity (Amabile, 1996) was not validated in these results.

Another limitation of the study involves the singular focus on person-level analysis of the variables. Team-level analyses could strengthen an understanding of Odyssey of the Mind as a developmental context supportive of creative needs. Methodologically, it is important to test the motivational climate reported by each team and perhaps develop a mechanism to examine uniqueness in each team’s microsystem. Such an approach may allow a more rigorous examination of contextual factors that are most conducive to creativity development during adolescence. For example, what might be an external motivator to an individual may not be as salient in a group. Similarly, some contextual factors such as provision of autonomy support, structure, and involvement may be weighted differently by adolescent youth compared to college-aged emerging adults.

This study was further limited in its scope by not examining the extent to which sample characteristics accounted for variability in the data. For example, it is possible that these may have influenced youth perceptions of the Odyssey of the Mind program. Team composition is central to describing the context; therefore, future directions might include analyses that account for regional team differences (i.e., rural versus suburban versus urban) or team member experience (i.e., number of years on an Odyssey of the Mind team, experience with previous team members, gender make-up of the team, academic placements of team members, etc.) or quality of the coaching (e.g., experienced teacher as coach versus inexperienced parent volunteer). There are many opportunities for better describing the team context for future work. In addition to not modeling these contextual features of the Odyssey of the Mind context, there were some methodological limitations. First, data were collected on the day of competition. Such
a heightened climate may have influenced how youth responded to the questions asked of them and may have interfered with their creative performance on the verbal divergent thinking tasks.

Although the testing environment was conducive to research with youth (i.e., a quiet, designated classroom with ample space), the administration took approximately an hour which may have been too long for youth whose attention was focused on their performances. For example, those teams for whom their scheduled participation times were in the afternoon may have not supplied the best representations of their verbal creativity as a result of fatigue from the day’s events.

Another methodological limitation involved the scoring of the “top three” ideas youth selected as their most creative. As previously mentioned, adopting this method provided the researcher an efficient yet sufficient approach for obtaining a large enough data set to serve as a sample of creative ideation for the cohort; however, very few youths utilized the full three minutes allotted during the divergent tasks’ administration. The researcher observed that when youth ceased to generate novel ideas on their own, they would scan the room for inspiring objects. This tendency resulted in a number of uncommon ideas submitted for analysis. For example, an uncommon response to the stimulus for “instances of something round” might have been “clock” (a concrete object visually evident in the classroom). The limitation arises when youth selected these ideas as one of their “most creative” from their candidate ideas to be scored by the raters.

Future Research

This dissertation study suggests a number of possible future directions for research. The most pressing need is to extend investigations of how need satisfaction and need frustration occur in out-of-school learning environments where creative production is an outcome variable.
Within such contexts, the role of competition as a contextual factor that supports domain-specific creative thinking and behaviors can be examined. There are many possible candidates for such work: FIRST Lego League Robotics Competitions, Destination Imagination, Future Problem-Solving, hackathons, STEM-based inventors’ fairs, etc. If such a research were to be undertaken, it would be important to investigate team-level versus within-person perceptions of the contexts. Teams are microsystems with their own microclimates. If basic psychological needs for autonomy, relatedness, and satisfaction are “nutrients” for human flourishing, could these same “nutrients” be nourishment also for creativity development, especially during adolescence.

Recently, Barbot, Besançon and Lubart (2016) argued that nonlinearity in creativity development was an interaction between person-level factors, task-specific demands, and environmental influences. Using findings from the deep well of Self-Determination Theory knowledge about what supports autonomously controlled motivation and supports basically psychological needs will be a potential useful and robust line of inquiry for new scholars committed to creativity growth in youth. Future directions for research might also strive to integrate recently validated findings on the influence of creative self-efficacy, creative mindsets, and beliefs about exemplary creativity with overlapping concepts in Self-Determination Theory.

Several other lines of inquiry are possible as well. Another important direction for future research is to examine how motivation regulatory styles mediate the connection between need satisfaction and creative performance. To what extent do the extrinsic motivations to engage in creative pursuits have an important, unique role in creative production? This information could help foster interventions in contexts where motivation is likely to be externalized for most youth.

Similarly, research on the ways that other contextual factors, such as competition, functions to support (or to thwart) domain-specific creative thinking and behaviors is needed.
Would these results be stable over time? What might it look like for motivation to engage in creative processes year-after-year with the same kids in the same context? How might these relationships play out among different student populations? Finally, given the wide use of divergent tasks as predictive measure of creative potential, there is a need to aggregate responses across studies in which adolescent youth provide responses so that an archive of “typical” answers may be built, and an improved test manual may be developed. Such a resource would help research determine which ideas are statistically infrequent (originality) versus those that are common.

**Conclusion**

Creativity is a highly valued human ability. To build the capacity to think creatively is to cultivate the capacity to not only solve problems but to discover them. Sometimes problem-finding results in cataclysmic shifts in how we live and interact. For example, the world before Thomas Edison’s light bulb was both a literally and metaphorically dark time. The world before Apple’s iPhone was one with fewer demands on our executive functioning. Yet, creativity is not just needed to solve the world’s grand problems; creativity is needed for human well-being and wholeness.

When work is done to better understand how contextual factors contribute to the development of creativity in adolescence, a host of positive outcomes are likely to unfold. Not only may youth who are afforded such contextual supports gain in competence and confidence, but society will undoubtedly benefit. This study sought to examine how adolescent youth perceived their motivations within a creative problem-solving program and to take first steps in understanding what might be considered “creative needs.” Ultimately, a model that explicates
what is needed for creative thinking and behaviors to be fostered among adolescents could aid researchers and practitioners with new methods to improve the lives of many.
References


https://doi.org/10.1207/S15327574IJT0101_4


https://doi:10.1037/a0038688


https://www.doi.10.1080/10888691.2017.1288124

https://doi:10.1007/s10648-009-9107-x

https://doi:10.1037/edu0000133


https://doi.org/ezproxy.lib.usf.edu/10.1002/jocb.395


https://doi:10.1037/h0063487


Hofferber, N., Basten, M., Großmann, N., & Wilde, M. (2016). The effects of autonomy-supportive and controlling teaching behaviour in biology lessons with primary and
secondary experiences on students’ intrinsic motivation and flow-experience.


https://doi:10.1080/09500693.2016.1229074


https://doi:10.1037/bul0000125


https://doi.org/10.1080/10705519909540118


Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology, 102*(3), 588-600. [https://doi.org/10.1037/a0019682](https://doi.org/10.1037/a0019682)


[https://dx.doi.org/10.1080/10400419.2013.843401](https://dx.doi.org/10.1080/10400419.2013.843401)


https://doi.org/10.1207/s15326934crj1202_1


Plucker, J.A. & Makel, M. (2010). Assessment of creativity. In R. Sternberg and J. Kaufman (Eds.), *The Cambridge Handbook of Creativity*. 48-73. [https://doi.10.1017/CBO9780511763205.005](https://doi.10.1017/CBO9780511763205.005)


https://doi.org/10.1006/ceps.1999.1020

https://doi.org/10.1037/0003-066X.55.1.68


Silvia, P.J. (2015). Intelligence and creativity are pretty similar after all. Educational Psychology Review 27, 599–606, [https://doi.org/10.1007/s10648-015-9299-1]


https://doi:10.1080/17439760.2016.1257049


https://doi.org/10.1007/s11031-019-09818-1


Appendix A: Odyssey of the Mind Long-Term Problems for 2019

2018-19 Long-Term Problem Synopses

Tentative as of April 28, 2018. All problems have an 8-minute time limit.

Problem 1: OMER to the Rescue Again
Who better to help those in distress than OMER? In this problem, OMER and his trusty Sidekick travel to different places with suitcases holding all of the parts of an OMER-mobile vehicle! OMER and his Sidekick will assemble and ride on the vehicle where it will function in different ways to “save the day.” Between attempts, the vehicle will be disassembled, put back into the suitcases, and taken to a different area where it will be reassembled and driven again. Finally, the OMER-mobile is thrown a hero’s parade as a show of appreciation!
Divisions I, II & III

Problem 2: Hide in Plain Sight
Teams take a cue from nature in this problem where they create and build a team-made mechanical creature that hides in plain sight. The creature will change its appearance three times to avoid being detected by a Searcher Character trying to find it. The way the creature changes will be different each time! The team will create and present a performance where its creature gets into – or out of – various situations using this resourceful skill. In the end the creature will surprise everyone by changing its appearance a final time and reveal its true self.
Divisions I, II, III & IV

Problem 3: Classics... Leonardo’s Workshop
Imagine how inspiring Leonardo DaVinci’s (LDV) workshop must have been. Teams will portray his workplace in an original, creative performance that includes LDV, a patron, and a naysayer. The team will recreate a DaVinci painting, make a three-dimensional representation of one of his works, and recreate another LDV work in any form the team wishes. There will also be an original “debunked” creation that LDV “invented” but discarded because it was mocked. Ironically, the item will be shown as something commonly used in modern times.
Divisions I, II, III & IV

Problem 4: Structure Toss
Step right up and put your structure to the test! Teams must strategize risk for points and “toss” their structures in this year’s problem-turned-carnival. They will use a device to propel the structure in a carnival game. If it travels in the air it gets higher score! Once the structure has been successfully tossed, it can be tested for strength. A carnival Barker character will entice other characters to join the fun during a performance that incorporates testing the structure’s strength with creative games of skill and chance. Divisions I, II, III & IV

Problem 5: Opposites Distract
Disagreements can distract groups from seeing the bigger picture. Teams will create and present a humorous performance about a sneaky character that distracts others while trying to take control of anything the team wishes. In the performance it will lure others into silly arguments and be successful two times. The arguments will be presented using different dramatic styles and will include attention-getting effects. In the end, the groups will learn that they have been intentionally distracted and will catch the sneaky character before it takes control.
Divisions I, II, III & IV

Primary: Museum Makers
Kids can see the extraordinary in the ordinary. Now they will use that ability to create their own museum! The team will create and present an original museum and its exhibits. During the performance, the team will reveal three creative displays that explain the theme of the museum and show off team-made items. A tour guide will take audiences on a journey through the museum to meet a humorous artist and a curator. Grades K-2

All problems copyright Creative Competitions, Inc. — 2018
Appendix B: Letter of Support

Ms. Megan Atha Just  
PhD Candidate  
Educational Psychology Program  
Department of Educational and Psychological Studies  
College of Education  
University of South Florida  
Office: EDU 380H  
Phone: (239) 898-4393  
mjust@mail.usf.edu

Dear Ms. Just,

Please accept my commitment, and that of the Florida Odyssey of the Mind, to your proposed dissertation study, “Early Adolescents’ Needs Satisfaction and Frustration, Motivation, and Divergent Thinking in and Out of School Context.”

Odyssey of the Mind is a creative problem-solving program for students K-12 and college. It provides teams with the opportunity to learn creative problem-solving, teamwork, brainstorming, self-reliance, and respect for individual strengths – unique, unforgettable experiences that will serve them in every aspect of their lives now and in the future.

The project aims to expand the knowledge base about how developmental contexts like Odyssey of the Mind relate to the basic psychological needs of competence, autonomy, and relatedness, to different types of motivation, and to verbal divergent thinking (an important cognitive process related to creativity) among early adolescent youth. This study has the potential to answer important questions regarding the specific context of Odyssey of the Mind on youth development.

Sincerely,

Matthew Whaley  
Association Director  
Florida Odyssey of the Mind

www.odysseyofthemin.com www.floridaodyssey.org
Appendix C: Parent Informed Consent Form

Study ID:Pro00039233 Date Approved: 2/27/2019

Parental Permission for a Child to Participate in Research
Information for parents to consider before allowing your child to take part in this research study

Title: Early Adolescents’ Needs Satisfaction and Frustration, Motivation, and Verbal Divergent Thinking within an Out-of-School Context

Pro # 00039233

Overview: We are asking you to allow your child to take part in a research study. The following information is being presented to help you and your child decide whether or not your child should participate in a research study. The sections in this Overview provide the basic information about the study. More detailed information is provided in the remainder of the document.

When we use the term “you” in this document, we are referring to your child.

Study Staff: This study is being led by Megan Atha Just who is a doctoral student in the Educational Psychology program at the University of South Florida. This person is called the Principal Investigator. She is being guided in this research by Dr. Darlene DeMarie.

Study Details: The purpose of the study is to learn more about how participating in out-of-school programs like Odyssey of the Mind may meet (or thwart) three basic psychological needs (e.g., competence, autonomy, and relatedness) in early adolescence and about how participation in Odyssey relates to motivation to engage in creative thinking processes. Finally, we hope to examine the relationship of needs satisfaction and frustration to actual creative thinking (“divergent thinking”) of individual youth.

This study is being conducted at the Odyssey of the Mind Sun Regional Tournament on March 2, 2019 and will take approximately one hour to complete. If your child participates, a time will be scheduled that does not interfere with your child’s performances at the Sun Regional Tournament (e.g., long-term and spontaneous). A time will be chosen that best fits with your child’s team schedule for the day of the event.

As part of the study, your child will be asked to complete two questionnaires that should take about 20-30 minutes to complete. These will ask you about your perceptions of the Odyssey of the Mind practices, your interest, and enjoyment in the activities as well as about your motivation to do Odyssey of the Mind. After completing the questionnaires, you will be asked to complete six creativity tasks. These should take about 15-20 minutes to complete these creativity tasks.

Participants: Your child is being asked to take part in a research study about how early adolescent youth (ages 10-14) perceive the environment of the Odyssey of the Mind Creative Problem-Solving program. Your child is being asked to take part in this research study because he or she is a participant in the Sun Regional Tournament of Odyssey of the Mind. If your child takes part in this study, you will be one of about 250 early adolescent youth taking part this year.
Voluntary Participation: Your child’s participation is voluntary. Your child does not have to participate and may stop your participation at any time. There will be no penalties or loss of benefits or opportunities if your child does not participate or decides to stop once you start. Your decision to allow your child to participate or not to participate will not affect his or her performance at Odyssey of the Mind.

Benefits, Compensation, and Risk: We do not know if you will receive any benefit from your participation. You will not be compensated for your participation. This research is considered minimal risk. Minimal risk means that study risks are the same as the risks you face in daily life.

Confidentiality: Even if we publish the findings from this study, we will keep your study information private and confidential. Anyone with the authority to look at your records must keep them confidential.

Study Procedures:

If you take part in this study, the researcher will meet you at the designated location at the scheduled time for the research participation. The researcher will introduce you to the purposes of the study and confirm that you are still interested in participating. You are free to change your mind at any time. Adults other than the researcher will not be permitted in the room during the study administration. We want to make sure that participating youth feel very comfortable answering the questions honestly. Keeping the room clear of outside influence or distractions helps with this. Once your child has completed the questionnaires and the creativity tasks, your child will be offered a small token of appreciation. When all Odyssey of the Mind team members have finished completing the questionnaires and creativity tasks, the researcher will notify the coaches. Either a coach or a parent/guardian will be permitted to pick up participants at the research room. You will be asked to complete a demographic form that supplies some background information about your child. This information is completely anonymous and will not be tied directly to identifying information about your child. Your child will be asked to complete two paper-and-pencil questionnaires and one creativity test of “divergent thinking.”

The following questionnaires will be administered:

- **Basic Psychological Needs Satisfaction and Frustration Scale** (24 items). This questionnaire asks youth to assess how the Odyssey of the Mind context satisfies (or thwarts) the basic psychological needs for competence (e.g., “I feel competent to achieve my goals during Odyssey of the Mind”), autonomy (“I feel pressured to do too many things.”), and relatedness (“I feel close and connected with other people who are important to me at Odyssey of the Mind”).

- **Modified Self-Regulation Questionnaire** (32 items). This questionnaire asks youth to assess the types of motivation they experience during Odyssey of the Mind (e.g., “I participate in Odyssey of the Mind because it’s fun” or “I try to come up with creative responses during Odyssey of the Mind because that’s what I’m supposed to do.”)

- **Unusual Uses Tasks** (6 tasks). These tasks ask youth to generate as many creative ideas as possible to six prompts (e.g., unusual uses for a newspaper or instances of something that is square.”

Total Number of Participants

About 250 individuals will take part in this study at the Odyssey of the Mind Sun Regional Tournament. This number is based on the number of youth ages 10-14 who have registered for the competition.
Alternatives / Voluntary Participation / Withdrawal
You do not have to participate in this research study. You should only take part in this study if you want to volunteer. You should not feel that there is any pressure to take part in the study. You are free to participate in this research or withdraw at any time. There will be no penalty or loss of benefits you are entitled to receive if you stop taking part in this study.

Benefits
You will receive no direct benefit(s) by participating in this research study. You may find that participating is enjoyable and that you learn something new about adolescent development.

Risks or Discomfort
This research is considered to be minimal risk. That means that the risks associated with this study are the same as what you face every day. There are no known additional risks to those who take part in this study.

Compensation & Costs
You will receive no payment for taking part in this study. However, you will receive a token of appreciation in the form of an Odyssey of the Mind “problem pin” from one of the previous years of Odyssey competitions.

Conflict of Interest Statement
There is no apparent conflict of interest for the researcher in the carrying out of this study.

Privacy and Confidentiality
We will do our best to keep your child’s records private and confidential. We cannot guarantee absolute confidentiality. Your child’s personal information may be disclosed if required by law. Certain people may need to see you or your child’s study records. These individuals include:

- The research team, including the Principal Investigator.
- Certain government and university people who need to know more about the study. For example, individuals who provide oversight on this study may need to look at your records. This is done to make sure that we are doing the study in the right way. They also need to make sure that we are protecting your rights and your safety.
- The USF Institutional Review Board (IRB) and its related staff who have oversight responsibilities for this study, and staff in USF Research Integrity and Compliance.

We may publish what we learn from this study. If we do, we will not include you or your child’s name. We will not publish anything that would let people know who you are.

You can get the answers to your questions, concerns, or complaints.
If you have any questions, concerns or complaints about this study, call Megan Atha Just at (239) 898-4393. If you have questions about your rights, complaints, or issues as a person taking part in this study,
call the USF IRB at (813) 974-5638 or contact by email at RSCH-IRB@usf.edu.

While we are conducting the research study, we cannot let you see or copy the research information we have about you. After the research is completed, you have a right to see the information about you, as allowed by USF policies.

Consent for My Child to Participate in this Research Study
I freely give my permission to let my child take part in this study. I understand that by signing this form I am agreeing to let my child take part in research. I have received a signed copy of this form to take with me.

________________________________________________
Signature of Parent of Child Taking Part in Study Date
[Authorization]

________________________________________________
Printed Name of Parent of Child Taking Part in Study

_____________________________________
Printed Name of the Child Taking Part in Study
Appendix D: Youth Assent Form

Study ID: Pro00039233 Date Approved: 2/27/2019

Assent of Children to Participate in Research

Pro #00039233

Title of study: Early Adolescents' Needs Satisfaction and Frustration, Motivation, and Verbal Divergent Thinking within an Out-of-School Context

Why am I being asked to take part in this research?
You are being asked to take part in a research study about how kids ages 10-14 think about Odyssey of the Mind as a place that motivates kids to engage in creative thinking activities. You are being asked to take part in this research study because you are in Odyssey of the Mind and you are somewhere between the ages of 10 and 14. If you take part in this study, you will be one of about 200 people at this site.

Who is doing this study?
This study is being led by Megan Atha Just who is a doctoral student in the Educational Psychology program at the University of South Florida. This person is called the Principal Investigator. She is being guided in this research by Dr. Darlene DeMarie.

What is the purpose of this study?
By doing this study, we hope to learn more about how participating in out-of-school programs like Odyssey of the Mind may meet (or not meet) three basic psychological needs (e.g., competence, autonomy, and relatedness) in early adolescence. Finally, we hope to examine the relationship of needs satisfaction and frustration to creative thinking of individual youth.

Where is the study going to take place and how long will it last?
The study will take place at the Odyssey of the Mind Sun Regional Tournament. You will be asked to participate in one visit which will take about 60 minutes. The total amount of time you will be asked to volunteer for this study is 90 minutes over the next month, including reading this form and signing it.

What will you be asked to do?
If you take part in this study, the researcher will meet you, your coach, and your team members at the designated location on the scheduled day for the research participation. The researcher will introduce you to the purposes of the study and confirm that you are still interested in participating. You are free to change your mind at any time. No adults other than the researcher will be permitted in the room during the study administration. We want to make sure that you feel very comfortable answering the questions honestly.
Once you have completed the questionnaires and the creativity tasks, you will be offered a small token of appreciation. When all your team members have finished, the researcher will notify your coach and you will be picked up at the research room.

You will be asked to complete two questionnaires and one creativity test. The following questionnaires will be administered:

- **Basic Psychological Needs Satisfaction and Frustration Scale** (24 items). This questionnaire asks you to assess how the Odyssey of the Mind context satisfies (or does not satisfy) basic psychological needs for competence (e.g., "I feel competent to achieve my goals during Odyssey of the Mind").
- **Autonomy** (“I feel pressured to do too many things.”), and relatedness (“I feel close and connected with other people who are important to me at Odyssey of the Mind”).
- **Modified Self-Regulation Questionnaire** (32 items). This questionnaire asks youth to assess the types of motivation they experience during Odyssey of the Mind (e.g., "I participate in Odyssey of the Mind because it’s fun” or I try to come up with creative responses during Odyssey of the Mind because that’s what I’m supposed to do.")
- **Unusual Uses Tasks** (6 tasks). These tasks ask youth to generate as many creative ideas as possible to six prompts (e.g., unusual uses for a newspaper or instances of something that is square).

**What things might happen if you participate?**
To the best of our knowledge, your participation in this study will not harm you. Although we have made every effort to try and make sure this doesn’t happen, you may find some questions we ask may upset you. If so, we will tell you and your parents or guardian about other people who may be able to help you with these feelings.

**Is there benefit to me for participating?**
We cannot promise that you will receive benefit from taking part in this research study. However, some people have enjoyed being part of a research study, and you might find participating interesting as well.

**What other choices do I have if I do not participate?**
You do not have to participate in this research study. It is completely your choice to participate.

**Do I have to take part in this study?**
You should talk with your parents or guardian and others about taking part in this research study. If you do not want to take part in the study, that is your decision. You should not participate because you want to volunteer.

**Will I receive any compensation for taking part in this study?**
You will not receive any compensation for taking part in this study.

**Who will see the information about me?**
Your information will be added to the information from other people taking part in the study so no one will know who you are.
Can I change my mind and quit?
If you decide to take part in the study, you still have the right to change your mind later. No one will think badly of you if you decide to stop participating. Also, the people who are running this study may need for you to stop. If this happens, they will tell you when to stop and why.

What if I have questions?
If you have any questions, concerns or complaints about this study, call Megan Atha Just at (239) 898-4393. If you have questions about your rights, complaints, or issues as a person taking part in this study, call the USF IRB at (813) 974-5638 or contact by email at RSCH-IRB@usf.edu.

Assent to Participate
I understand what the person conducting this study is asking me to do. I have thought about this and agree to take part in this study. I have been given a copy of this form.

Name of person agreeing to take part in the study ________________________________ Date ________________

Signature of child agreeing to take part in the study: ________________________________

Printed name & Signature of person providing Information (assent) to subject ________________________________ Date ________________
Appendix E: IRB Certificate of Approval

February 28, 2019

Megan Just
Educational and Psychological Studies
Tampa, FL 33612

RE: Expedited Approval for Initial Review
IRB #: Pro00039233
Title: Early Adolescents’ Needs Satisfaction and Frustration, Motivation, and Verbal Divergent Thinking in an Out-of-School Context

Study Approval Period: 2/27/2019

Dear Ms. Just:

On 2/27/2019, the Institutional Review Board (IRB) reviewed and APPROVED the above application and all documents contained within, including those outlined below. Please note this study is approved under the 2018 version of 45 CFR 46 and you will be asked to confirm ongoing research annually in place of a full Continuing Review. Amendments and Reportable Events must still be submitted per USF HRPP policy.

Approved Item(s):
Protocol Document(s):
Creative Needs_IRB PROTOCOL_Version #1_Feb22_2019_Pro00039233.docx

Consent/Assent Document(s)*:
Child Written Assent_Version #1_February 22_2019.docx.pdf
SB Parental Permission_Version#1_February 27_2019.docx.pdf

*Please use only the official IRB stamped informed consent/assent document(s) found under the "Attachments" tab. Please note, these consent/assent documents are valid until the consent document is amended and approved.
It was the determination of the IRB that your study qualified for expedited review which includes activities that: (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45 CFR 46.110. The research proposed in this study is categorized under the following expedited review category:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies

This research involving children as participants was approved under 45 CFR 46.404. Research not involving greater than minimal risk to children is presented.

Requirements for Assent and/or Permission by Parents or Guardians: 45 CFR 46.408
Permission of one parent is sufficient.
Assent is required of all children.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB via an Amendment for review and approval. Additionally, all unanticipated problems must be reported to the USF IRB within five (5) business days.

We appreciate your dedication to the ethical conduct of human subjects research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

[Signature]

Kristen Salomon, Ph.D., Chairperson
USF Institutional Review Board
Appendix F: Youth Demographics Form

We are interested in your thoughts about participating in Odyssey of the Mind. When answering the questions below, please focus on what you really think about participating Odyssey of the Mind and not on how you wish your experience to be. First, we would like to get some information about you.

Please answer the following questions by placing a mark (X) on the lines that apply to you.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other (write in):</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race</th>
<th>Black/African American</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asian/Pacific Islander</td>
<td>Native American</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>Other/Mixed Race</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Academic Placement</th>
<th>Gifted Services</th>
<th>No Gifted Services</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Years in OM</th>
<th>New to OM</th>
<th>5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 year</td>
<td>6 years</td>
</tr>
<tr>
<td></td>
<td>2 years</td>
<td>7 years</td>
</tr>
<tr>
<td></td>
<td>3 years</td>
<td>8 years</td>
</tr>
<tr>
<td></td>
<td>4 years</td>
<td>9 years</td>
</tr>
</tbody>
</table>
Appendix G: Modified Basic Psychological Need Satisfaction and Frustration Scale

We are interested in the ways that participating in Odyssey of the Mind meets your basic psychological needs. Listen to each sentence as it is read aloud to you and decide whether the statement sounds like it is talking about a person like you or like a person different from you.

Before we start, let’s practice.

A. I like ice cream.
   Very True (4) Sort of True (3) Not Very True (2) Not True at All (1)

B. I enjoy reading books.
   Very True (4) Sort of True (3) Not Very True (2) Not True at All (1)

Please circle the answer that is most true of you during your experiences in Odyssey of Mind.

1. During Odyssey of the Mind, I feel that I have choice and freedom in the things I try.
   Very True Sort of True Not Very True Not at All True

2. Most of the things I do at Odyssey of the Mind feel like things I am required to do.
   Very True Sort of True Not Very True Not at All True

3. I feel that the people I care about at Odyssey of the Mind also care about me.
   Very True Sort of True Not Very True Not at All True

4. I feel excluded from the Odyssey of the Mind team I belong to.
   Very True Sort of True Not Very True Not at All True

5. I feel confident that I can do things well during Odyssey of the Mind.
   Very True Sort of True Not Very True Not at All True

6. I have serious doubts about whether I can do things well during Odyssey of the Mind.
   Very True Sort of True Not Very True Not at All True

7. I feel that my decisions on the Odyssey of the Mind project reflect what I really want.
8. During Odyssey of the Mind, I feel forced to do many things I wouldn’t choose to do.

Very True Sort of True Not Very True Not at All True

9. During Odyssey of the Mind, I feel connected with people who care for me.

Very True Sort of True Not Very True Not at All True

10. During Odyssey of the Mind, I feel that people who are important to me are cold and distant towards me.

Very True Sort of True Not Very True Not at All True

11. During Odyssey of the Mind, I feel capable at what I do.

Very True Sort of True Not Very True Not at All True

12. I feel disappointed with many of my performances during Odyssey of the Mind.

Very True Sort of True Not Very True Not at All True

13. For the Odyssey of the Mind project, I feel my choices express who I really am.

Very True Sort of True Not Very True Not at All True

14. I feel pressured to do too many things during Odyssey of the Mind.

Very True Sort of True Not Very True Not at All True

15. During Odyssey of the Mind, I feel close and connected with other people who are important to me.

Very True Sort of True Not Very True Not at All True

16. I have the impression that people I spend time with during Odyssey of the Mind dislike me.

Very True Sort of True Not Very True Not at All True

17. During Odyssey of the Mind, I feel competent to achieve my goals.

Very True Sort of True Not Very True Not at All True
18. During Odyssey of the Mind, I feel insecure about my abilities.

Very True    Sort of True    Not Very True    Not at All True

19. When working on the Odyssey of the Mind tasks, I feel I have been doing what really interests me during Odyssey of the Mind.

Very True    Sort of True    Not Very True    Not at All True

20. My Odyssey of the Mind activities feel like things I have to do.

Very True    Sort of True    Not Very True    Not at All True

21. I experience a warm feeling with the people I spend time with during Odyssey of the Mind.

Very True    Sort of True    Not Very True    Not at All True

22. During Odyssey of the Mind, I feel the relationships I have are just not close.

Very True    Sort of True    Not Very True    Not at All True

23. During Odyssey of the Mind, I feel I can successfully complete difficult tasks.

Very True    Sort of True    Not Very True    Not at All True

24. I feel like a failure because of the mistakes I make during Odyssey of the Mind.

Very True    Sort of True    Not Very True    Not at All True
Appendix H: Modified Self-Regulation Questionnaire – Academic (SRQ-A)

**WHY DO I PARTICIPATE IN ODYSSEY OF THE MIND?**

1. Because I want other people to think I’m a good team member.
   Very True    Sort of True    Not Very True    Not at All True

2. Because I’ll get in trouble if I don’t.
   Very True    Sort of True    Not Very True    Not at All True

3. Because it’s fun.
   Very True    Sort of True    Not Very True    Not at All True

4. Because I will feel bad about myself if I don’t do it.
   Very True    Sort of True    Not Very True    Not at All True

5. Because I want to understand creative problem-solving in Odyssey of the Mind.
   Very True    Sort of True    Not Very True    Not at All True

6. Because that’s what I’m supposed to do.
   Very True    Sort of True    Not Very True    Not at All True

7. Because I enjoy doing my OM work.
   Very True    Sort of True    Not Very True    Not at All True

8. Because it’s important to me to do my assigned OM tasks.
   Very True    Sort of True    Not Very True    Not at All True

**WHY DO I HELP DEVELOP CREATIVE SOLUTIONS TO THE “LONG-TERM” PROBLEM?**

9. So that others won’t yell at me.
   Very True    Sort of True    Not Very True    Not at All True

10. Because I want other people to think I’m a good OM team member.
   Very True    Sort of True    Not Very True    Not at All True
WHY DO I HELP DEVELOP CREATIVE SOLUTIONS TO THE “LONG-TERM” PROBLEM?

11. Because I want to learn new things.
    Very True          Sort of True          Not Very True          Not at All True
12. Because I’ll be ashamed of myself if it didn’t get done.
    Very True          Sort of True          Not Very True          Not at All True
13. Because it’s fun.
    Very True          Sort of True          Not Very True          Not at All True
14. Because that’s the rule.
    Very True          Sort of True          Not Very True          Not at All True
15. Because I enjoy doing Odyssey of the Mind.
    Very True          Sort of True          Not Very True          Not at All True
16. Because it’s important to me to work on Odyssey of the Mind.
    Very True          Sort of True          Not Very True          Not at All True

WHY DO I TRY TO COME UP WITH CREATIVE RESPONSES DURING THE “SPONTANEOUS THINKING” PRACTICE ACTIVITIES?

17. Because I want the other team members to think I’m creative.
    Very True          Sort of True          Not Very True          Not at All True
18. Because I feel ashamed of myself when I don’t try.
    Very True          Sort of True          Not Very True          Not at All True
    Very True          Sort of True          Not Very True          Not at All True
20. Because that’s what I’m supposed to do.
    Very True          Sort of True          Not Very True          Not at All True
**WHY DO I TRY TO COME UP WITH CREATIVE RESPONSES DURING THE “SPONTANEOUS THINKING” PRACTICE ACTIVITIES?**

21. To find out if I’m right or wrong.

   Very True       Sort of True       Not Very True       Not at All True

22. Because it’s fun to solve problems creatively.

   Very True       Sort of True       Not Very True       Not at All True

23. Because it’s important to me to try to be creative in Odyssey of the Mind.

   Very True       Sort of True       Not Very True       Not at All True

24. Because I want others to say nice things about me.

   Very True       Sort of True       Not Very True       Not at All True

**WHY DO I TRY TO DO WELL AT ODYSSEY OF THE MIND COMPETITION?**

25. Because that’s what I’m supposed to do.

   Very True       Sort of True       Not Very True       Not at All True

26. So other people will think I’m a good Odyssey of the Mind team member.

   Very True       Sort of True       Not Very True       Not at All True

27. Because I enjoy doing well at Odyssey of the Mind.

   Very True       Sort of True       Not Very True       Not at All True

28. Because I will get in trouble if I don’t do well.

   Very True       Sort of True       Not Very True       Not at All True

29. Because I’ll feel really bad about myself if I don’t do well.

   Very True       Sort of True       Not Very True       Not at All True

30. Because it’s important to me to try to do well in Odyssey of the Mind.

   Very True       Sort of True       Not Very True       Not at All True
WHY DO I TRY TO DO WELL AT ODYSSEY OF THE MIND COMPETITION?

31. Because I will feel really proud of myself if I do well.
   Very True     Sort of True     Not Very True     Not at All True

32. Because I might get a reward if I do well.
   Very True     Sort of True     Not Very True     Not at All True
Appendix I: Verbal Divergent Thinking Measures Protocol

Note: The following script was obtained from Dr. Paul Silvia at the University of North Carolina at Greensboro via email correspondence dated January 18, 2018. Dr. Silvia and colleagues have worked to improve the test instructions for Guilford’s (1967) various “uses tasks,” which are standard measures of verbal divergent thinking. The script has been slightly modified to situate the DT tasks within the larger study on the Odyssey of the Mind context.

Researcher Script:

Our study today is not only about how you experience Odyssey of the Mind as a place that supports you. Our study is also about how Odyssey of the Mind is a program about creativity. We are interested in learning how people think creatively and are able to come up with original, innovative ideas. Everyone can think creatively, and we’d like to learn more about how people do it.

So, you will work on a few different creativity tasks, too. All of these tasks are pretty short and are at most only a few minutes long. Any questions so far?

1. Here is the first creativity task. For this task, you should write down all of the original and creative uses for a brick that you can think of. Certainly, there are common, unoriginal ways to use a brick; for this task, write down all of the unusual, creative, and uncommon uses you can think of. You’ll have three minutes. Any questions? Okay. Three minutes starts now. 3 MINUTES.

That’s time. Now, take a look at what you wrote down, and then pick which two are your most creative ideas. Just circle the two that you think are your best. Okay, now put that sheet into the file folder, and we’ll move onto the next one.

2. Here’s another creativity task. For this task, you should write down all of the original and creative instances of things that are round that you can think of. Certainly, there are some obvious things that are round; for this task, write down all of the unusual, creative, and uncommon instances of things that are round. You’ll have 3 minutes. Any questions? Okay. 3 MINUTES.

That’s time. Now, take a look at what you wrote down, and then pick which 2 are your most creative ideas. Just circle the 2 that you think are your best. Okay, now put that sheet into the file folder, and we’ll move onto the next one.

3. Here’s a different kind of creativity task. For this task, imagine that people no longer had to sleep, meaning that if they wanted to, people could stay awake for their entire lives. What would happen as a consequence? Write down all of the original, creative consequences of people no longer needing to sleep. You’ll have 3 minutes. Any questions? Okay. 3 MINUTES.
That’s time. Now, take a look at what you wrote down, and then pick which 2 are your most creative ideas. Just circle the 2 that you think are your best. Okay, now put that sheet into the file folder, and we’ll move onto the next one.

4. Okay, for this creativity task, you should write down all of the original and creative uses for pencil that you can think of. Certainly, there are common, unoriginal ways to use a knife; for this task, write down all of the unusual, creative, and uncommon uses you can think of. You’ll have 3 minutes. Any questions? Okay. 3 MINUTES.

That’s time. Now, take a look at what you wrote down, and then pick which 2 are your most creative ideas. Just circle the 2 that you think are your best. Okay, now put that sheet into the file folder, and we’ll move onto the next one.

5. For this creativity task, you should write down all of the original and creative instances of things that will make a noise that you can think of. Certainly, there are some obvious things that will make a noise; for this task, write down all of the unusual, creative, and uncommon instances of things that will make a noise. You’ll have 3 minutes. Any questions? Okay. 3 MINUTES.

That’s time. Now, take a look at what you wrote down, and then pick which 2 are your most creative ideas. Just circle the 2 that you think are your best. Okay, now put that sheet into the file folder, and we’ll move onto the next one.

6. Here’s the last creativity task. For this one, imagine that every person shrank to 12 inches tall, meaning that everyone was now only a foot high. How would this change things? Write down all of the original, creative consequences of people shrinking to a foot tall. You’ll have 3 minutes. Any questions? Okay. 3 MINUTES.

That’s time. Now, take a look at what you wrote down, and then pick which two are your most creative ideas. Just circle the 2 that you think are your best. Okay, now put that sheet into the file folder, and we’ll move onto the next one.
### Appendix J: Item-Level Descriptive Statistics Motivation Regulatory Styles

Table 1A

*Means, Standard Deviations, Skewness, and Kurtosis of Observed Motivation Variables (N=101)*

<table>
<thead>
<tr>
<th>Observed Variables</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External Regulation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Because I'll get in trouble if I don't.</td>
<td>100</td>
<td>1.14</td>
<td>0.47</td>
<td>3.97(^{a})</td>
<td>17.42(^{a})</td>
</tr>
<tr>
<td>2. Because that’s what I’m supposed to do.</td>
<td>100</td>
<td>1.39</td>
<td>0.72</td>
<td>2.03(^{a})</td>
<td>3.86(^{a})</td>
</tr>
<tr>
<td>3. So that others won’t yell at me.</td>
<td>100</td>
<td>1.30</td>
<td>0.64</td>
<td>2.18(^{a})</td>
<td>4.12(^{a})</td>
</tr>
<tr>
<td>4. Because that's the rule.</td>
<td>100</td>
<td>1.57</td>
<td>0.95</td>
<td>1.55</td>
<td>1.20</td>
</tr>
<tr>
<td>5. Because that's what I'm supposed to do.</td>
<td>99</td>
<td>1.77</td>
<td>0.91</td>
<td>0.89</td>
<td>-0.27</td>
</tr>
<tr>
<td>6. Because I want others to say nice things about me.</td>
<td>99</td>
<td>1.92</td>
<td>0.99</td>
<td>0.61</td>
<td>-0.93</td>
</tr>
<tr>
<td>7. Because that's what I'm supposed to do.</td>
<td>100</td>
<td>2.23</td>
<td>1.14</td>
<td>0.34</td>
<td>-1.31</td>
</tr>
<tr>
<td>8. Because I will get in trouble if I don't do well.</td>
<td>100</td>
<td>1.36</td>
<td>0.70</td>
<td>2.02(^{a})</td>
<td>3.54(^{a})</td>
</tr>
<tr>
<td>9. Because I might get a reward if I do well in Odyssey of the Mind.</td>
<td>101</td>
<td>1.69</td>
<td>0.91</td>
<td>1.13</td>
<td>0.28</td>
</tr>
<tr>
<td><strong>Introjected Regulation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Because I want the others to think I’m a good student.</td>
<td>100</td>
<td>1.81</td>
<td>0.88</td>
<td>0.74</td>
<td>-0.46</td>
</tr>
<tr>
<td>2. Because I will feel bad about myself if I don’t do it.</td>
<td>100</td>
<td>1.49</td>
<td>0.76</td>
<td>1.59</td>
<td>2.12(^{a})</td>
</tr>
<tr>
<td>3. Because I want others to think I’m a good student.</td>
<td>100</td>
<td>2.49</td>
<td>1.05</td>
<td>-0.03</td>
<td>-1.18</td>
</tr>
<tr>
<td>4. Because I’ll be ashamed of myself if it didn’t get done.</td>
<td>100</td>
<td>1.87</td>
<td>1.03</td>
<td>0.72</td>
<td>-0.89</td>
</tr>
<tr>
<td>5. Because I want others to think I'm smart.</td>
<td>99</td>
<td>1.88</td>
<td>0.94</td>
<td>0.78</td>
<td>-0.39</td>
</tr>
<tr>
<td>6. Because I feel ashamed of myself when I don't try.</td>
<td>99</td>
<td>2.22</td>
<td>1.05</td>
<td>0.25</td>
<td>-1.17</td>
</tr>
<tr>
<td>7. So others will think I'm a good Odyssey of the Mind team member.</td>
<td>100</td>
<td>2.50</td>
<td>1.09</td>
<td>-0.10</td>
<td>-1.23</td>
</tr>
<tr>
<td>8. Because I'll feel really bad about myself if I don't do well.</td>
<td>100</td>
<td>2.30</td>
<td>0.96</td>
<td>0.13</td>
<td>-0.95</td>
</tr>
<tr>
<td>9. Because it's important to me to try to do well in Odyssey of the Mind.</td>
<td>101</td>
<td>3.50</td>
<td>0.82</td>
<td>-1.63</td>
<td>1.82</td>
</tr>
<tr>
<td><strong>Identified Regulation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Because I want to understand creative problem-solving in Odyssey of the Mind.</td>
<td>100</td>
<td>3.25</td>
<td>0.81</td>
<td>-1.07</td>
<td>0.96</td>
</tr>
<tr>
<td>2. Because it’s important to me to do my Odyssey of the Mind work.</td>
<td>100</td>
<td>2.32</td>
<td>1.09</td>
<td>0.14</td>
<td>-1.30</td>
</tr>
<tr>
<td>3. Because I want to learn new things.</td>
<td>100</td>
<td>3.37</td>
<td>0.84</td>
<td>-1.21</td>
<td>0.72</td>
</tr>
<tr>
<td>4. Because it's important to me to work on Odyssey of the Mind.</td>
<td>100</td>
<td>3.06</td>
<td>0.98</td>
<td>-0.84</td>
<td>-0.28</td>
</tr>
<tr>
<td>5. To find out if I'm right or wrong.</td>
<td>99</td>
<td>1.85</td>
<td>0.91</td>
<td>0.81</td>
<td>-0.23</td>
</tr>
</tbody>
</table>
Table 1A (Continued)

<table>
<thead>
<tr>
<th>Identified Regulation</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Because it's important to me to try to be creative in Odyssey of the Mind.</td>
<td>99</td>
<td>3.49</td>
<td>0.80</td>
<td>-1.75</td>
<td>2.71a</td>
</tr>
<tr>
<td>7. Because it's important to me to try to do well in Odyssey of the Mind.</td>
<td>101</td>
<td>3.48</td>
<td>0.77</td>
<td>-1.46</td>
<td>1.66</td>
</tr>
</tbody>
</table>

**Intrinsic Motivation**

<table>
<thead>
<tr>
<th>Item Number on Measure</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Because it's fun.</td>
<td>100</td>
<td>3.71</td>
<td>0.54</td>
<td>-1.71</td>
<td>2.06a</td>
</tr>
<tr>
<td>2. Because I enjoy doing my Odyssey of the Mind work.</td>
<td>100</td>
<td>3.65</td>
<td>0.67</td>
<td>-1.89</td>
<td>2.82a</td>
</tr>
<tr>
<td>3. Because it's fun.</td>
<td>100</td>
<td>3.67</td>
<td>0.65</td>
<td>-2.22a</td>
<td>5.06a</td>
</tr>
<tr>
<td>4. Because I enjoy doing Odyssey of the Mind.</td>
<td>100</td>
<td>3.71</td>
<td>0.66</td>
<td>-2.69a</td>
<td>7.55a</td>
</tr>
<tr>
<td>5. Because I enjoy solving problems creatively.</td>
<td>99</td>
<td>3.69</td>
<td>0.62</td>
<td>-2.08a</td>
<td>4.20a</td>
</tr>
<tr>
<td>6. Because it's fun to solve problems creatively.</td>
<td>99</td>
<td>3.69</td>
<td>0.70</td>
<td>-2.47a</td>
<td>5.88a</td>
</tr>
<tr>
<td>7. Because I enjoy doing Odyssey of the Mind work well.</td>
<td>100</td>
<td>3.64</td>
<td>0.75</td>
<td>-2.29a</td>
<td>4.80a</td>
</tr>
</tbody>
</table>

Note. *a* Indicates skewness and kurtosis outside the range of acceptable normality.

Table 2A

**Item Stems Aligned to Item Number on Motivation Measure**

<table>
<thead>
<tr>
<th>Measure Domain</th>
<th>Intrinsic</th>
<th>Identified</th>
<th>Introjected</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Why do I participate in Odyssey of the Mind program?</td>
<td>3, 7</td>
<td>5, 8</td>
<td>4, 7</td>
<td>1, 6</td>
</tr>
<tr>
<td>2. Why do I help develop creative solutions to the “long-term” problem?</td>
<td>13, 15</td>
<td>11, 16</td>
<td>10, 12</td>
<td>9, 14</td>
</tr>
<tr>
<td>3. Why do I try to come up with creative responses during the “spontaneous thinking” activities?</td>
<td>19, 22</td>
<td>21, 23</td>
<td>17, 18</td>
<td>20, 24</td>
</tr>
<tr>
<td>4. Why do I try to do well at Odyssey of the Mind competition?</td>
<td>27</td>
<td>30</td>
<td>26, 29, 31</td>
<td>25, 28, 32</td>
</tr>
</tbody>
</table>